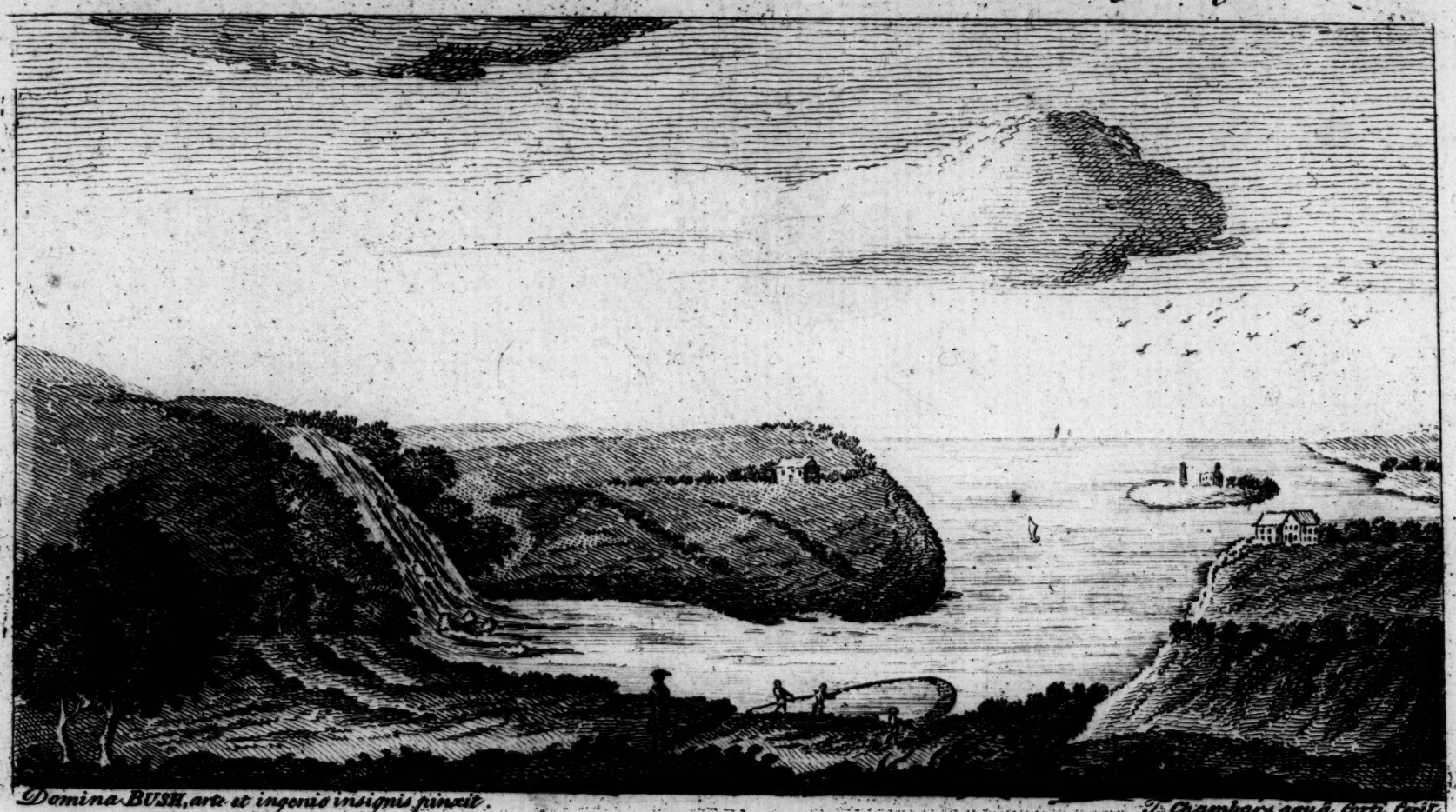
Frontispiece

A PERSPECTIVE VIEW

Of part of LOUGH NEAGH, the River Camlin alias Crumlin, and the Country adjacent.



Domina BUSH, arte et ingenio insignis pinxit. — T. Chambars aquâ forti fecit.

The ISLAND now called RAM'S ISLAND, formerly INNIS GARDEN, has in it the Ruins of a Church, with a round Tower, which is of the kind of buildings the most ancient in IRELAND. Directly opposite to the TRAVELLER upon the bank of the River, was found the ΛΑΑΣ ΑΝΑΙΔΗΣ, hereafter described.

33 c 11

LECTURES
IN
NATURAL PHILOSOPHY,
DESIGNED,
To be a foundation, for reaſoning pertinently,
UPON THE
PETRIFICATIONS, GEMS, CRYSTALS,
AND
SANATIVE QUALITY
OF
Lough NEAGH in *IRELAND*;
And intended to be
An Introduction, to the NATURAL HISTORY
OF
Several COUNTIES contiguous to that LAKE;
PARTICULARLY
The County of ARDMAGH.

By RICHARD BARTON, B. D. Author of The ANALOGY of DIVINE WISDOM, in the Material, Senſitive, Moral, Civil, and Spiritual Syſtem of Things.

K.

Naturæ opera, non prodigia conſectamur. Plin. Nat. Hiſt. Lib. 7.

Deſine quapropter novitate exterritus ipſâ
Exſpuere ex animo rationem; ſed magis acri
Judicio perpende; et ſi tibi vera videtur,
Dede manus. Lucretius, Lib. 1.

Sumptus impendimus, et pro inſtrumentis, et pro libris; itineribus, tempori non parcimus, ſudores profundimus, vires ipſas exhaurimus, ut D E I Creatoris, et Conſervatoris, ubique conſpicua gloria celebretur, et veritas ex D E I ſinu emanans protrahatur in Lucem.
Schuitzeri iter Alpinum octavum.

D U B L I N:
Printed for the Author, by A. REILLY, and ſold by GEORGE and ALEXANDER EWING, at the *Angel* and *Bible* in *Dame-ſtreet*. M,DCC,LI.



To the Learned

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OF

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AND

IRELAND;

And to the Learned and Inquisitive Members of the *Royal Society*, these LECTURES are most humbly dedicated.

Gentlemen,

NOvelty being that which principally pleases, these Lectures may at least convey one circumstance of Delight. It is several Centuries since Mankind spoke of the subjects of them with admiration; it is half a century since the Learned inquired diligently concerning them; and it is but six years, since the Phænomena were fairly discovered, to the general conviction of Observers: The Author claims no merit in any respect, but that of a diligent Inquirer, and faithful Relator. His own reasoning he offers with all humility, not to prevent, but to excite better reasoning from you.

I am, Gentlemen,

Your affectionate Fellow-labourer

In Literature and Religion,

As United,

RICHARD BARTON, B. D.

A

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N. B. * Denotes the writing medium paper. The names printed without a mark, are thoſe who ſubſcribed for the printing medium paper. Numeral figures annext denote the number of books ſubſcribed for.

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Wood, Archibold M. D.
Wetheral, Mr. Richard
Wynne, Rev. John D. D.
Wynne, Rev. John A. M.
Wynne, Mr. John
Waring, William Eſq; * *An.*
Warren, Mr. William * *An.*
Waring, Mr. Samuel Attorney
Ward, Bernard Eſq;
Ward, Rev. Bernard A. M. *An.*
Warde, Rev. William A. M.
Wyvil, Sir Marmaduke Bart.
Welſh, Rev. Dean *An.*
Wogan, Mr. John
Woodroff, Rev. Samuel
Wait, Mrs. Catharine
Wilſon, Mr. Peter
Workman Meredith Eſq;
Whitlock, Major Carlton
White, Mrs. Elizabeth
Wilſon, Mr. George
White, Mr. Solomon
Wilſon, Mr. Joſeph

Y.

Yielding, Mr. James
Young Mr. Andrew

THE AUTHOR His friendly ADDRESS TO HIS COUNTRYMEN.

IT is with pleaſure this writer obſerves, a moſt excellent ſpirit, ariſing in this Kingdom, along with increaſing opulence, to improve human nature. The magnificence of ſome habitations, the furniture of others, and the tables of them all, if they ſhould rather prove the luxury and wealth of the nation, yet are they alſo proofs of the former. Luxury grows up along with arts and ſciences. The Auguſtin age produced very great Geniuſes in the latter reſpect, as well as very corrupt Examples in the former: And every other age, wherein wealth abounds, whether in a Chriſtian or a Pagan ſtate, will produce the ſame ſeeming contradictory effects, till a more general ſpirit of reformation prevails. For the *moral* diſpoſitions of Mankind are extremely different, from thoſe which go under the title of *INGENIOUS*; and the improvement of the *latter* does by no means include the *former*. The *Ingenious* immoral man only differs from the *baſely vitious*, by becoming more exquiſite in his pleaſures; And *Lucretius*, almoſt the fineſt of poets, differs only from a *groſs blaſphemer* in the delicacy of his language and fancy. If Apicius taught a Roman to make a better *ſauce*, he did not thereby teach him to be *more temperate*. If Horace, whoſe writings are become the BIBLE of the age, paints his own cowardice (*relictâ non bene parmulâ*) with WIT that makes the reader forget *Cenſure*, he has not thereby inculcated the virtue of COURAGE; or if his fine addreſs to CÆSAR and MECÆNAS inchants the ear, the heart is not thereby taught that *reſolute* VIRTUE, which ſhould make a man ſteady to an *honeſt cauſe*, in which he has once engaged, and

and ever aſhamed to relinquiſh it, upon the *poor motive* of dictating to *School-Boys*, that vitious *Theme* of flattery;

Principibus placuiſſe viris &c.

The improvement therefore of human nature in *ingenuity* is a very different conſideration, from the more excellent improvement of it in (*a*) MORAL CONDUCT. This writer, not knowing, when the laſt excellent diſpoſition to improve Mankind in pure morals will ariſe, yet always wiſhing for it, and hoping this is a good preparatory ſeaſon, is willing to congratulate with his COUNTRYMEN even upon the former: And having lately laid before them part of his labours in the laſt reſpect, is willing alſo to compliment them with ſome of his labours in the firſt; In as much as delicate pleaſures are as much preferable to choquing VICE, as *refined ſatyr* is to *ſcurrility*.

In this way of conſidering things he is contented to act as a philoſopher: And hoping to procure the eſteem of his countrymen in this, he may perhaps afterwards come forth again in the other more HONOURABLE *Character* of a DIVINE, to which his ſtudies are principally devoted by VOW and INCLINATION. With this view he is willing to help them for ſome time as far as lies within his skill, to BUILD, and PLANT, and TASTE their WINES; or *to dig with them, in the bowels of the earth, for* the hidden treaſures of nature.

As a ſmall ſpecimen of this diſpoſition he offers this book, being the effect of SIX YEARS INQUIRY, much bodily and mental labour, as well as pecuniary expence. *Mechanic arts* are every day improving in Ireland, and the *liberal arts*, it is hoped, will keep pace with them (*b*). The true way to give encouragement to the latter, is

(*a*) The more people there are in a nation who ſtand in need of addreſs amongſt themſelves, and caution not to diſpleaſe, there will be the more politeneſs: but it is more a politeneſs of morals, than manners, which ought to diſtinguiſh us from a barbarous people.
De l'eſpirit des Loix.

(*b*) This book is printed upon paper made in Ireland; with types and gravings alſo of the artificers of the country.

A late writer has complimented Ireland in a genteel manner, and it is hoped, the ſpirit of improvement continuing may give others occaſion to ſpeak praiſe-worthy things of it; and if its inhabitants ſhould not think as honourably of themſelves, as that gentleman has expreſt himſelf of them, their modeſty will not deduct any thing at all from their merit, if they have it in the degree mentioned.

" *IRELAND*

is to invite thoſe of thought, attention, and activity, to appear gracefully in public, by treating with humanity and generoſity, what as writers, they offer with humility and affection.

It is hoped the reader will not think himſelf detained too long from the principal ſubject of this book, if ſome objections to ſubſcribing to books, be conſidered and anſwered; ſeeing it is by that method this book is introduced into the world, and without it the liberal arts can not eaſily be improved in this Kingdom. There are two ſorts of editors, authors, and bookſellers: The Inquirer apprehends the bookſellers are able to anſwer for themſelves, and as an author, he thinks himſelf obliged to anſwer for authors, although it ſhould ſeem needleſs, in a nation, which is only beginning to print its own literary productions, in its own cities, and where it is not known that any price is given to an author for his manuſcripts. Yet upon account of ſome extraordinary cavillers, who ſuggeſt even before fact or experiment, objections which

" *IRELAND*, Britain's younger ſiſter, ſeemeth to have uſeful and ornamental arts : " Yet Ireland, at theſame time, doth not want ſcholars, orators, poets, or philoſophers. The " ſciences and arts, when they once become acquainted, are extreme good friends: they " love, promote, and heighten each other : Were the experiment to be made here, a man " would run no great riſk in becoming accountable for the conſequence. And ſhould we " not be diſpleaſed, as a nation, to be ranked by foreigners after one of our own colo- " nies ?

The ſame writer remarks of his own country, its inferiority to France in one particular reſpect, wherein he is pleaſed to ſay Ireland has got the ſtart ; and expreſſes himſelf ſtrongly. " Shall we not be fired with emulation to rival theſe neighbours, who are our con- " firmed enemies in politics, while they triumph over us in their regular method of in- " troduction to the arts ? It has been ſaid, that England is a century behind France in learn- " ing, and politeneſs. I have proved that this aſſertion does not in general hold good; " but it is punctually true, with regard to an inſtitution of the nature we are pleading for." To wit an academy for painting, ſculpture and architecture J. Gwyn, Eſſay on Deſign;

Who alſo ſays, " In England art has hitherto been hidden, obſtructed, or diſregarded " ——————art has been in ſmall eſtimation, unleſs the artiſt was foreign. Our " neighbours have ſpoken contemptuouſly of us without reſerve, (The Abbé le Blanc's " Lettres, publiſhed in Engliſh in 1747, afford remarkable inſtances of this,) and the few " Engliſhmen who have indiſputably excelled, were ſcarcely rewarded with honeſt and " impartial approbation from their own countrymen.

It is wiſhed Ireland would conſider, how much reaſon there is to be affected with the contempts thrown upon it: Notwithſtanding the praiſe this gentleman has beſtowed out of a good intention to ſpirit up his own countrymen, the IRISH ſhould act as thoſe who had not yet a title to or poſſeſſion of praiſe, but in the way to deſerve and obtain it.

which ſhould be founded upon them; ſhort anſwers ſhall be given to the moſt common.

One thing ſhould be previouſly remark'd, that whatever weight the objections to ſubſcribing to the printing of books may have in regard to authors, the mechanical arts of printing, graving, and the manufactures belonging to them, ſhould be encouraged: So that the printing even of a ſenſeleſs book, is, in theſe reſpects, rather a benefit than an injury to the public: But at preſent the caſe of an author in reſpect to ſubſcriptions, ſhall be principally conſidered; and particularly that of an author, who is only entering into the world, and has a public reputation to acquire: For thoſe of eſtabliſhed fame do not often ſtand in need of the method of publication by ſubſcription.

A ſubſcriber has a very juſt right, to compute paper and ink, comparatively with the ſum demanded, when a ſubſcription is aſked for a book already publiſhed. But when an author publiſhes his own original work, there ſhould be an allowance for him, in that character, over and above what might be aſked in the other reſpect. If this be not allowed to be reaſonable, a very great diſcouragement is thrown upon ingenuity and pains taking; and literature muſt ſuffer exceedingly by it. How therefore can any gentleman juſtify a reſolution never to ſubſcribe to any book? For there are ſome imprudent enough to declare this injudicious, perhaps avaritious reſolution.

Is it becauſe they have been ſometimes impoſed upon by editors, in the delay of the works promiſed, or perhaps in the not performing at all what was promiſed, or in the unworthineſs of the performance? Or is it becauſe the perſons ſollicited to ſubſcribe are ignorant? (*c*)

As to delay, the objection is light; the work is better thereby. And ſurely the intereſt of money ſubſcribed for books, is hardly worth computing; and if it be, the better execution of the work is a ſufficient compenſation. Perhaps the delays are owing to the want of generoſity in thoſe, before whom propoſals are laid, and not to the author; or to ſome intervening events inſcrutable to human wit; which ſhould always be a ſufficient apology.

As

(*c*) Some perſons are not aſhamed to own their ignorance of what it would be their Glory to know, and even to charge others with it, rather than part with a ſmall ſum to encourage liberal arts.

As to a non-performance of promiſe to the public; perhaps this may be owing in ſome caſes to one cauſe of the former, to wit, events impoſſible to be foreſeen: If to diſhoneſty, the author means not to apologize; A writer ſhould at leaſt have the common quality indiſpenſible in all dealers, a diſpoſition to act upon the ſquare: But ſince bankrupcy avowedly fraudulent, does not deſtroy the reaſonable confidence due to honeſty, and the merchant ſtill gives credit to the fair dealer, ſo ſhould it be in this caſe.

As to the unworthineſs of the performance, upon which it is likely the objectors lay a great ſtreſs, it is as weak as any of them. For ſhall a man reſolve never to give alms, becauſe being ſometimes deceived, he has given to unworthy objects? As no one, but an uncharitable perſon, can make this reſolution; ſo no one, but a diſcourager of literature, can reſolve never to ſubſcribe to the printing of any book.

Beſides, gentlemen ſhould take care how they hazard the diſcouraging of any one, who may have extraordinary talents *(d)* in a nation, by not encouraging many perſons, who have them in an ordinary proportion. Reputation is a ſufficient bar to all adventurers in print, who are not abandoned; and an author muſt be a known proſtitute, before ſuch a character can be given of him without injuſtice. The ſenſe of reputation which is inſeparable from human nature, till it becomes extremely vitiated, ſhould be a ſufficient reaſon for preſumption, that there is ſome foundation for worth in the performance.

As to ignorance, which ſome perſons more bold than prudent charge to many orders of men; the Inquirer owns, that he has heard almoſt five hundred times, that there are only five hundred READERS in Ireland. He does not know upon what methods of information this is aſſerted *(e)*; but it is

(d) It is ſaid that Sir Walter Raleigh and Doctor Cudworth, burned a great part of their valuable writings, upon account of the ill grounded contempt of the world to what they publiſhed. How dearly would the diſcerning part of Mankind purchaſe theſe writings now, could they be purchaſed?

(*e*) Perhaps their information is taken from bookſellers, who ſay, they rarely ſell more than five hundred copies of the beſt books. The Inquirer can aſſure the reader, that he diſpoſed of one thouſand books of the Analogy of Divine Wiſdom, (in the material, ſenſitive, moral and ſpiritual ſyſtem of things,) tho' intirely a book of religion, which is not the moſt palatable ſubject of this age; and he hears that a book giving an account of Lord A——n's voyage, was only ſold to the number of two thouſand, in which there was not one word of religion, not the name of God or Divine Providence, yet abounding with deliverances almoſt miraculous.

plain, there ought to be a great many more, if all the orders of literary profeſſions be computed. Let any one conſider the number of Lords, Commons, Clergy, Judges, Lawyers, Phyſicians, the Members of an Univerſity, conſiſting of five hundred perſons, and the officers of a ſtanding army of twelve thouſand men, with many perſons of wealth and education, not belonging to any of theſe orders, and then ask the queſtion; how many reading men amongſt all thoſe? If the anſwer could be conſiſtent with truth, only five hundred; would it not be proper to ask? Are laws made with judgment, or expounded with skill? Is religion ſupported with learning, and chriſtianity inforced with authority and ſtrength of reaſoning? And is the practice of medicine in repute? And how do the gentlemen of the army ſpend their time in barracs; and many perſons their lives of eaſe and retirement, having wealth by inheritance? *

Let theſe queſtions be anſwered by others. For notwithſtanding that ſtrange opinion, which it is hoped, has no foundation, the Inquirer upon a preſumption that there are many readers in Ireland, and encouragers of literature, and out of a real affection to his country, is an adventurer in print. He offers with all humility and deference ſome of his philoſophic labours to the public, aſſuring the learned and humane reader, that he does not mean to impoſe upon him either common phænomena or common reaſoning, but ſomething of novelty in in the latter, as well as the former; yet he hopes with ſuch ſtrength of argumentation, as may be the foundation of a correct judgment, and may merit rather the thanks of the courteous reader, than contempt. However, if the latter ſhould be the conſequence, he may at leaſt comfort himſelf with the conſciouſneſs of a well meaning deſign, and a ſhare in the glory of the motto, *in magnis voluiſſe ſat eſt.*

For to attempt to reſcue a country from unmerited diſgrace by the pen, is no leſs glorious, than to engage in its deliverance from ſlavery, by the ſword. It is to be wiſhed that this was the ſentiment of every writer

* There is a great occaſion to ſpeak here of avarice, but that rather belongs to preaching. Poverty alſo deſerves a conſideration, in reſpect to ſome men of letters; but although ſometimes brought voluntarily upon them, it excites pity, rather than cenſure. The circumſtances of ſuch perſons is very unpleaſant, who cannot do a ſmall act of generoſity to the community, without an act of injuſtice to their families.

(*f*) See an account of printing in Ireland, ſent from thence to Joſeph Ames, F. R. S. 1749.

writer of this country: But he, who gave the laſt account of printing, ſays, *They that value their reputation, commonly ſend their writings to England to be printed (f).* It would ſeem vain to expreſs an emulation with England for liberal arts; but however unequal the compariſon would be, it could not be liable to any bad conſequence, the very principle of emulation being an excellent ſpur to all things praiſe-worthy: Newton and Leibnitz were emulous to the advantage of mankind.

The SUN need not be jealous of the ſtars, till they increaſe in luſtre, and come nearer to an equality of viſible magnitude and ſplendor; and our generous neighbours cannot, but with pleaſure ſee us, even attempt to imitate their beſt works; and if a little concern be expreſt for the diſpoſition amongſt us, to ſend almoſt all our reputable works to their large Shop of reputation, they will allow it to be an affection that is not culpable, to wiſh well to the credit of a native ſoil. How ſmall a proportion does the number of preachers of religion in Ireland, bear to thoſe of Great-Britain; thoſe of the church by law eſtabliſhed, being only twelve hundred, including CURATES, who are deſerving of a place in all arithmetic concerning religion and literature, in this iſland; ſince their labours contribute greatly to the ſupport of both, in the characters of ſchool-maſters and authors, as well as curates. How ſmall a proportion does its Univerſity, conſiſting of five hundred perſons, and in proportion, all orders of men in the kingdom (the whole being perhaps as two millions to ten) bear to all the Univerſities of Great-Britain, and to all orders of men in that extenſive, ingenious, induſtrious, opulent iſland. It is not therefore likely that the utmoſt efforts of Ireland, in the Liberal Arts can excite an injurious jealouſy.

The Inquirer was not without encouragement to print in England, having invitations from ſome very good patrons of literature, ſome of whom have intereſt in a large Univerſity, and ſome in a Royal Society, whoſe reputation is acknowledged, wherever inſenſate nature affords

(*g*) The author being a conſiderable diſtance from the place where moſt of his papers lie, cannot here give a copy of the letter mention'd, but having another from the ſame excellent perſon extremely polite, and to the purpoſe of this deſign, he takes liberty to publiſh it.

SIR, Ormond-ſtreet, April 27, 1750.

I Received from Meſſieurs Knapton, the copies of your excellent book of Divine Analogy, &c. I paid him for ſix, and read it with a great deal of pleaſure. I have now your propoſals

phænomena, and human nature ſtudies them. If among theſe one gentleman be particularly named, it is hoped, he will not be *diſpleaſed*, and certainly the reader can not but be *pleaſed*. The learned Doctor MEAD did generouſly promiſe by letter *(g)*, to publiſh the materials of this book to the beſt advantage for the author. This is here taken notice of, as well to acknowledge the high regard he bears to theſe eminent patrons of literature, as to give him ſome title to eſtimation in his own country, for at leaſt ſeeming to wiſh himſelf honour in it, although invited to ſearch for it elſewhere, by thoſe, who were able to give it. As a confirmation of which he adjoins a copy of a letter from the Univerſity of Cambridge, in anſwer to one of his, being an acknowledgment of a pre-

propoſals for printing Lectures in Natural Philoſophy. I make no queſtion, but this book will afford me the ſame ſatisfaction with the former. I deſire you will put me down a ſubſcriber for ſix copies; I wiſh you moſt heartily all manner of happineſs and ſucceſs, in your uſeful undertakings, &c.

The Inquirer thinks it a reſpect due to the Univerſity where he was bred, not to omit expreſſions of good wiſhes to ſo learned a body, and which being contained in two letters, he will lay one of them before the reader.

Illuſtri Academiæ Dublinienſi R. Bartonus The. Bac. S. P. D.

HAud ita pridem ad vos miſi miraculi Lacus Neachi inſigne ſpecimen. Miraculum quidem, non quia contra naturæ leges aliquid exhibetur, ſed quia phænomenon, etiamſi legibus naturæ conſonum, rarum & mirandum. Quoniam nuper mihi contigit invenire plura hujuſcemodi ſpecioſa ſpecimina; horum eſſe participes vos precipúe dignamini; apud quos Philoſophia Newtoniana, quâ intima naturæ arcana reſerantur, colitur. Hæc (quicquid cogitat vulgus philoſophorum) per naturæ labyrinthum, per vias flexuoſas velut filo diſcipulos ducit: Ita vos me docuiſtis, ita credo, veſter amantiſſimus alumnus. Hæc igitur attractionis miranda ſpecimina vobis non ingrata fore confido: Grato ſaltem erga vos & ſtudia veſtra amori meo hæc puſilla dona tribuetis. Si alumni veſtri ſinguli vel tantulum colligerent, in quantum cumulum brevi accreverit philoſophica materia. Modo doctorum inventis, modo philoſphiæ Newtonianæ, modo veritati, per hæc noſtra fiat aliqua acceſſio, pro munere habebo.

Non animus eſt vos longâ morari epiſtolâ; breviter narrabo: Quod nuper dono dedi *, inſigne erat ſpecimen ligni ſuperficiei lapidis adhærentis & continui. Ni fallor (et ſenſus bene diſpoſiti non fallunt) quod nunc offertur, lignum intimè complectitur tanquam medullam lapidis; adeo ut tenera ligni materia duro lapide circumſepta quaſi munitur. Lapis, cujus exhibetur vobis fragmentum, viginti erat pondo.

BENE VALETE.

Datum Lurgano,
Sept. 18. 1745.

* This has reference to a former preſent made.

a preſent of natural rarities ſent ſome time before. Beſides, as that letter contains many curious inquiries, which this book is deſigned to anſwer, it is expedient to publiſh it; and as his honourable ſentiments of that Univerſity, were expreſt in his own letter, which are heightened by the kind acceptance and acknowledgment of his preſent, he deſires the favour of the courteous reader, to indulge him the liberty to lay that letter alſo before him.

Inclytæ Academiæ Cantabrigienſi R. Bartonus, S. P. D.

QUibus fama Lacus Neachi in Hiberniâ non eſt ignota, ſpecimina petrificationis miranda forſan non erunt ingrata. Diu eſt agitata quæſtio, utrum lignum queat in lapidem dureſcere? En maſſæ ingentis fragmina, in quibus lapis eſt ligno continuus, tam in corde quam in ſuperficie. Quo modo autem hoc fit, veſtrum eſt explicare. Natura miraculorum ubique ferax eſt, prout unumquodque phænomenon digito velut Dei nobis indicatur. Ille materiam format deformatque legibus, quas ipſe impoſuit materiæ primordiis rerum. Quiſquis harum incumbit ſtudio philoſophus evadit, imo theologus, & quo plures noverit leges eo magis ſophus: Catenam earum mirandam ſuſpicit, & qui ſuſtinet catenam adorat Deum. Dei omnia plena. Sive moveat, ſive quieſcat materia, ſive attrahant ſive repellant ſeſe ejus particulæ; et motus & quies non niſi ex Deo ſunt. Ita nos docuit philoſophia Newtoniana, ita vos docetis, eximii ejus cultores. Hæc rara & hermaphroditea cohæſionis ſpecimina accipiatis velim, teſtimonium æſtimationis meæ erga vos, doctiſſimi viri. Ignotus ad bene notos ſcribo. Quorum ſcripta leguntur, ipſi non celantur; quorum libri in bibliothecis reconditi doctorum manibus teruntur; eorum fama per hominum ora volitat. Si hoc puſillum donum vel tantulum conferat literis promovendis, vel mentem dubitantis figat, vel amorem erga notitiam rerum naturalium excitet, nihil aliud quæritur; Macte igitur ſtudiis eſte, beneque valete.

Datum Lurgano, in Comitatu Ardmacano, in Hiberniâ.

Octob. 2, 1745.

VIR

VIR REVERENDE,

INteger jam menſis abiit ex quo tuam epiſtolam mecum communicavit Vicecancellarius noſter, ut tam ſuo quam præfectorum collegiorum et totius ſenatus academici nomine ad te reſcribere, gratiaſque quam maximas agere velim. Hoc munus in me lubenter ſuſcepi: Quamvis enim tuam erga academiam, erga literas & philoſophiam veriorem benevolentiam ſtudiumque agnoſcerent omnes, et collaudarent, quibus doni tui utilitas ſatis perſpecta non eſſet; mihi vero præcipuè cordi fuit, diu ſperatis tandem frui exemplaribus, alibi forſan quam inter vos Hibernos fruſtra quærendis. Haud rara ligni petrificati ſpecimina præbet Anglia noſtra, quorum plurima vidi, nonnulla nactus ſum: Talia autem ſunt eorum nonnulla, ut quibuſdam ſuſpicionem haud immerito poſſint injicere, eadem vera ligna nunquam fuiſſe. Alia reperi ipſe, ſed rariſſima hæc, vera adhuc ligna ſaxo licet undique incluſa.——Tua autem exemplaria, cum ejuſdem pars una ſit adhuc lignum a ſtatu naturali parum recedens, cum interea pars reliqua ſit omnino in lapidem converſa, omnem dubitandi anſam etiam ab invitis prorſus extorquent. Teſtimonium omnibus muſæum Woodwardanum per aliquot forſan ſæcula viſuris præbitura.

Reſponſum diutius diſtuli, ut de reliquis exemplaribus nonnihil adnotarem: Cum vero quò minus commodè hoc fieri poterat, valetudo parum firma prohibuerit, neque limites epiſtolæ multa de iis dicenda admitterent; fuſius forſan olim, ſi tibi libet, tecum acturus, nolui ulterius reſponſum procraſtinare, quo certior eſſe poteras dona tua ad nos ſalva veniſſe.

Hoc interea te, Vir Reverende, rogatum velim, utrum vel ex tuis vel aliorum fide dignorum obſervationibus certè conſtare poſſit, ſaxea hæc ligna non aliquando ſub terrâ latuiſſe, & ex diuturno aquarum motu, exeſo ſtrato ambiente, in aquas tandem delapſa fuiſſe; ut enim verum fatear, vix animum meum inducere poſſum, ut credam aquæ ſoli hanc vim ineſſe.

Quod ſi partes non petrificatæ aquæ aut molliori luto fuerint expoſitæ, cum interea partes reliquæ ſabulo vel arenâ tegerentur, unde ſuam duritiem nanciſcerentur? Conjecturæ veniam dabis, quæ an vera ſit ex multis

multis datâ operâ factis, & inter ſe collatis obſervationibus ſolummodo determinari poteſt; quales ſi factæ unquam fuerant lubenter ſcire cupit, tibi jamjudum divinctiſſimus.

CAROLUS MASONUS.

Dabam 17 Kal. Jan. 1746.

Ex Collegio Sanctæ Trinitatis, in quo ſtudebant Baconus & Newtonus.

To the foreign teſtimonies in favour of the ſubject matter of the work may be added the celebrated names of Mr. Molyneux, Lhuyd, and others mentioned in the tranſactions of the Royal Society, as perſons deputed by that honorable Body to inquire into theſe things. Their ſentiments being printed, the reader may have recourſe to them, wherein he will find an acknowledgment of their having failed of ſucceſs in their ſearches. How far the Inquirer, who now offers his book to the public, upon the ſame ſubject, has ſucceeded, and what degree of eſteem his ſucceſs may deſerve, the reader is juſt upon the point of determining; who ſhall have no further interruption from him, than that of acquainting him, that this is a diſcharge of an obligation, to which the Inquirer was in ſome degree bound, by the promiſe of another gentleman, as appears from the following extract from the philoſophical tranſactions for the year 1746.

A letter from Mr. James Simon, of Dublin, to Martin Folkes Eſq; Pr. R. S. concerning the Petrifications of Lough Neagh, in Ireland.

I Received laſt Summer 1745, from my worthy and ingenious friend, the Rev. Mr. *Richard Barton*, about 30 of theſe ſtones, found on the ſhores of the lake, ſome in the water, ſome in the mud, ſome in the ſand, others in a yellowiſh clay, &c.——The curious gentleman above mentioned, who hath already begun, and intends, at his leiſure, to take an accurate ſurvey of the lake, will, I hope be able to give a more juſt and ſatisfactory account of its petrifying virtue, than I poſſibly can; my deſign in the preſent attempt, being only to pave the way, and induce others to make farther experiments in ſearch of truth, and for improving natural knowledge.

The

The Inquirer offers his book to the public, not as a full diſcharge of that ingenious gentleman's promiſe on his behalf, but only in the ſame manner in which he ſpeaks of his own attempt, TO PAVE THE WAY, AND INDUCE OTHERS TO MAKE FURTHER EXPERIMENTS IN SEARCH OF TRUTH, AND FOR IMPROVING NATURAL KNOWLEDGE, to which ſhall be added one circumſtance, SO FAR AS THAT KNOWLEDGE IS THE HANDMAID OF RELIGION, AND CLOSELY ATTENDANT UPON IT:

If the execution of the reaſoning part of this work be deemed a ſpecimen of any degree of credit, to the liberal arts in Ireland, as the ſubject matter is of the materials which this iſland can afford to the natural philoſopher; and as the type, paper, and gravings * are of the mechanic arts; and if others are hereby invited to promote the honour of Ireland in all reputable reſpects, NATURAL, MECHANIC MERCANTILE, and LITERARY, The editor's ambition is anſwered; as well as the benevolent wiſhes of all thoſe worthy perſons, whoſe names are printed; to whom the editor returns his cordial thanks for joining with him in ſo laudable a DESIGN.

* The frontiſpiece of this book was painted by a very ingenious Lady, almoſt from a verbal deſcription, and yet her pencil has come ſo near NATURE, that had ſhe drawn from it, would it be vain to have expected, that ſhe would have excelled it?

THE

Plate 2. fronting Lect: 1.

Fig: 1.

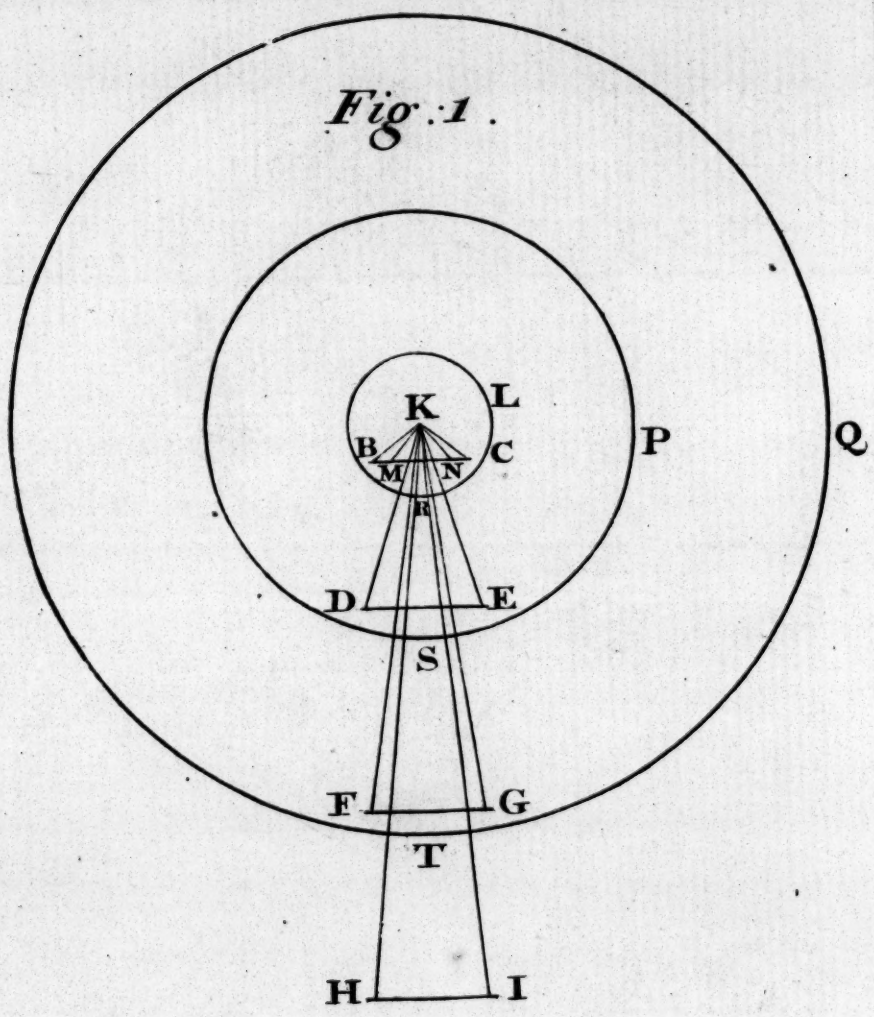


Fig: 2.

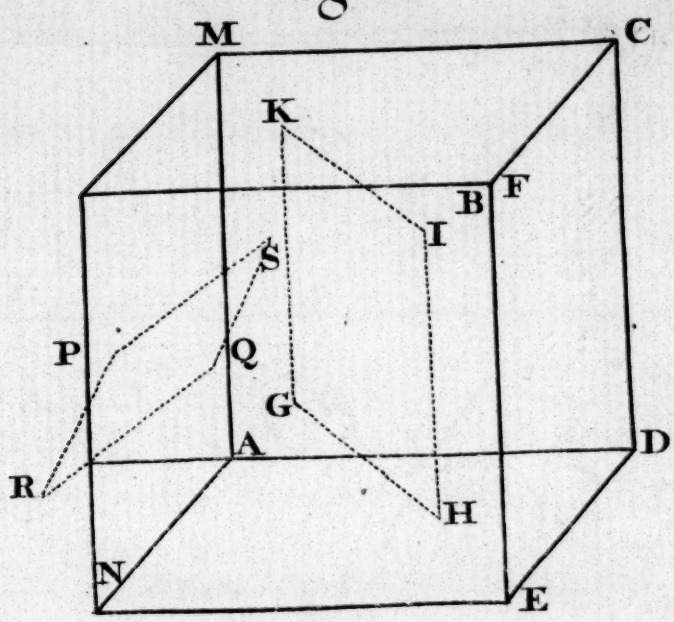
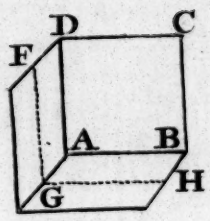


Fig: 3.



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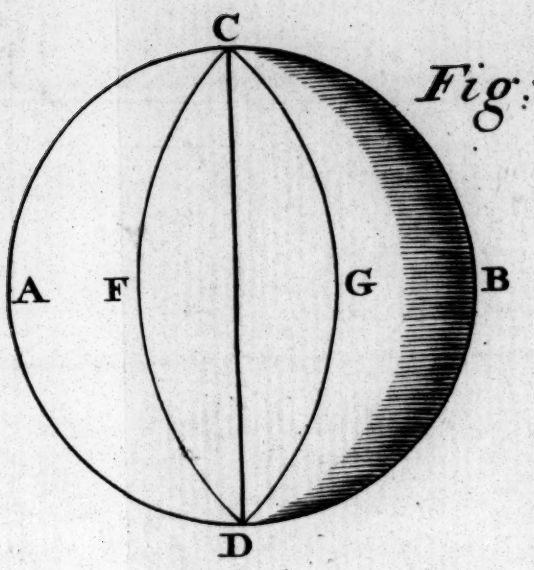
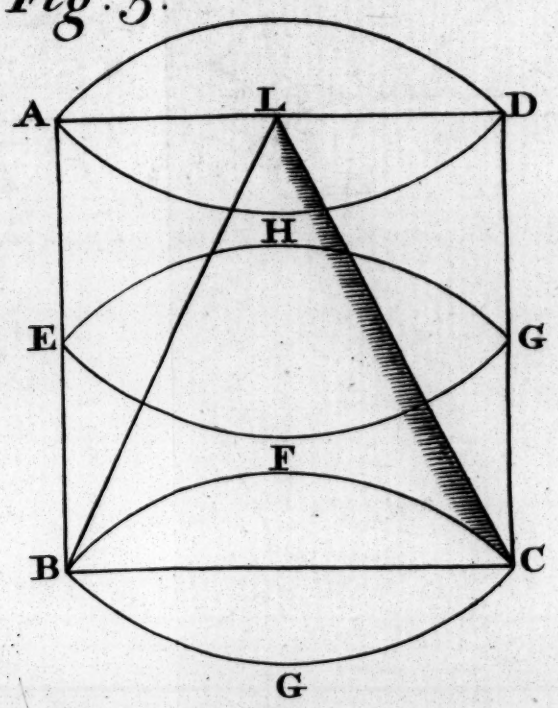


Fig: 4.

Fig: 5.



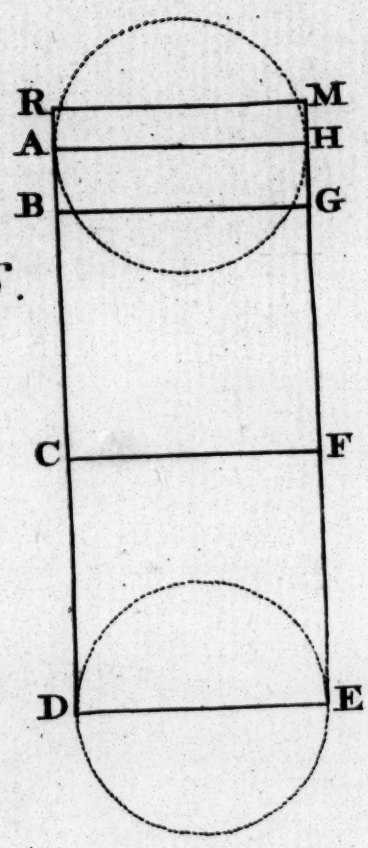


Fig: 6.

THE

Mathematical Elemental Lecture,

OR THE

NATURE

OF

Elementary MATTER, and KINDS,

Conſidered, and proved to be mixed;

TOGETHER WITH

Some UNIVERSAL PROPERTIES

OF

MATTER,

Demonſtrated MATHEMATICALLY,

In a new MANNER: And

A great uſe of theſe PROPERTIES ſhewn,

IN THE

SOLUTION

OF THE

Statical Phænomena of FLUIDS.

LECTURE I.

Nemo hujuſce (LECTURÆ) utilitatem, nemo veritatem ejus—— ſine Matheſeos ope comprehendet; cuilibet tamen in his vel mediocriter verſato quæ ſequuntur, non difficilia erunt aut obſcura.

 Keil. Tent. med. Præf.

LECTURE I.

THESE Lectures being deſigned as an attempt to explain ſome phænomena of nature, which have hitherto been the occaſion of more admiration than knowledge, it may firſt be proper to treat ſuccinctly of natural philoſophy. Becauſe the laws of matter being well eſtabliſhed, there is hereby a clear paſſage opened into many intricacies of Nature, ſome of which, although long deemed above human ability, have been demonſtrated to reſult from the known affections of matter.

As method has been always neceſſary in order to become intelligible, without which truth itſelf is not unlike falſhood: The vulgar diſtinction of matter into four elements, ſhall be obſerved in the following Lectures. I ſay the vulgar diſtinction; not meaning hereby to eſtabliſh them as really diſtinct original principles, prior to which there are none in the courſe of nature; this inquiry being too nice for the preſent: But ſeeing that the courſe of things is diſcovered, by proceeding from things moſt obvious to ſenſe, to thoſe arcana of nature which are leaſt ſo, it may be prudent to begin with the vulgar diſtinction of matter into four elements.

'For the great and judicious Lord Verulam, having divided the hiſtory of nature into five claſſes, makes the four elements the fourth claſs, FIRE, AIR, EARTH, and WATER; taking the elements not for primordial matter, but larger maſſes of natural bodies. For the nature of things is ſo laid out, as to form a very large quantity or maſs, of certain bodies in the univerſe; where an eaſy and looſe texture of matter is required to their ſtructure, as theſe four elements; whilſt there is but a proportionably ſmall quantity of certain other bodies in the univerſe; thus ſparingly ſupplied, by reaſon of a very diſſimilar and ſubtle texture of the matter, here made organical and determined in many particulars, as in the ſpecies of natural Bodies, Minerals, Plants, and Animals: whence the former may be called, *larger aſſemblages*, and the latter, *leſſer aſſemblages* of matter:

'But the order of Nature ſeems to point out to us, the conſideration 'of the larger aſſemblages as previous in order of knowledge, to the 'leſſer aſſemblages *(a)*.' Our method ſhall in ſome degree, be conſonant to this judicious remark, as well as the example of Sir Iſaac Newton, who intending to explain the phænomena of the Univerſe; firſt lays down in a demonſtrative way, what he juſtly calls, Philoſophiæ naturalis principia mathematica: It is to be wiſhed, that all reaſoners upon particular phænomena would obſerve the ſame method, and firſt lay down the principles upon which they ground ſolutions of the difficulties of Nature; giving next in order, the deſcriptions and hiſtory of the phænomena to be ſolved, and after that the application of the principles to them, that is, the explanation of their phyſical cauſes.

The Inquirer, in imitation of ſo excellent an example, gives firſt the properties of elemental matter, ſo far as he thinks himſelf at preſent concerned in their conſideration, partly mathematical, partly popular. The former manner of conſidering matter ſhould have been omitted, was it not entirely neceſſary to his ground work, not being ſo treated of by Sir Iſaac Newton, or any other perſon to his knowledge: After demonſtrating the properties of elemental matter, the deſcriptions and hiſtory of the phænomena to be treated are given, and then follows the application of the principles firſt demonſtrated, to the phænomena under inquiry, that is, the explanation of the ſeveral phyſical cauſes.

The Inquirer means that the two firſt Lectures ſhould be conſidered as the principles of his reaſoning, in any other phænomena which he may hereafter attempt to explain, particularly the giant's cauſway, in the northern parts of this kingdom; as well as the phænomena which make the title of this book. For that very extraordinary phænomenon was intended to be made part of this book; yet for prudent reaſons upon mature conſideration was omitted. To proceed therefore according to this method. ——

But as a caution previous to all the demonſtrations following, hear the ingenious Keil.

'I would not have any one in phyſical matters, inſiſt ſo much on a 'rigid method of demonſtration, as to expect the principles of demon-'ſtration, that is, axioms, ſo clear and evident in themſelves, as thoſe 'that

(*a*) Introduction to Sylva Sylvarum. Apho. 4.

'that are delivered in the elements of geometry. For the nature of 'the thing will not admit of ſuch. But we think it ſufficient, if we 'deliver ſuch as we apprehend are congruous to reaſon and expe- 'rience, whoſe truth ſhines out as it were, at firſt view, which procure 'the belief of ſuch as are not obſtinate, and to which no body can de- 'ny his aſſent, unleſs he profeſſes himſelf to be altogether a ſceptic.

'But alſo in demonſtrating, it is neceſſary to make uſe of a more 'lax ſort of reaſoning, and to exhibit propoſitions that are not abſolute- 'ly true, but nearly approaching to the truth. As for example, when 'it is demonſtrated that all the vibrations of the ſame pendulum, made 'in the ſmall arches of a circle, are of equal duration; it is here ſup- 'poſed, that the ſmall arch of a circle and its chord, are of the ſame 'declivity, and of the ſame length; which however, if we regard the 'rigid truth, is not to be admitted: But in phyſics, this hypotheſis va- 'ries ſo little from the truth, that the difference ought juſtly to be ne- 'glected, and the diſagreement of the vibrations ariſing from that dif- 'ference is altogether inſenſible, as is proved by experience. So like- 'wiſe that eminent philoſopher and geometer Dr. Gregory, in his ele- 'ments of catoptrics and dioptrics, makes uſe of a more lax geometry, 'by aſſuming lines and angles as equal, that in reality are unequal, tho' 'they accede nearly to an equality; and ſo he ſolves many beautiful 'phyſical problems, which otherwiſe would prove very intricate. 'And alſo this method ſeems to be approved of ſometimes by Sir Iſaac 'Newton himſelf, as may be ſeen in Prop. 3. lib. 2. of his Phil. Nat. 'prin. math. But if there are any who harden their minds againſt 'ſuch principles and demonſtrations, and will not ſuffer themſelves to 'be convinced by propoſitions ſufficiently manifeſt; we leave ſuch to 'enjoy their ſupine ignorance, nor do we think them worthy to be ad- 'mitted to the knowledge of the true philoſophy *(b)*.' With this allowance for a latitude in reaſoning upon natural phænomena, what follows may be admitted for phyſical demonſtration.

Every man has a diſtinct idea of air, fire, water, and earth, although the philoſopher by chymical proceſſes may torture them, and himſelf, ſo

(b) Introduction to Nat. Phil. Lectur. 8. See alſo Analogy of Divine Wiſdom, &c. part I. publiſhed by the Author, in Dublin, 1750.

ſo as to render it doubtful whether there be in nature ſuch an original diſtinction of elementary matter inconvertible one into another. Notwithſtanding that we have very diſtinct ideas excited by the common uſe of theſe words, yet are thoſe ideas very inadequate. Water is very diſtinguiſhable from air, earth, and fire, in the mind of every perſon; but an adequate idea of it, as being truly a mixt body, conſiſting of the pure original element of water, together with air, earth, and fire, in certain proportions, is not as often in the minds of thoſe who are philoſophically employed, as ſtrict reaſoning requires.

Yet ſuch is the nature of all water on this our globe; whether rain, fountains, rivers, or the ſea. And ſuch is the nature of the other elements, they are all mixt bodies, greatly impregnated with each other; which ſhall be demonſtrated in propoſitions.

PROPOSITION I.

Water has Earth, and Fire, and Air in it.

DEMONSTRATION.

Water has earth in it, otherwiſe it would not afford a terrene ſediment, when allowed to ſettle and ſubſide, nor throw it off ſuperficially in fermentation. It has fire in it, otherwiſe in a ſtorm the waves would not emit flame, and a ſmall proportion of it thrown upon fewel in high combuſtion, would not perhaps increaſe the fire, as by experiment it is known to do; and the air which ruſhes out of veſſels, in which water has been long confined, would not flame when toucht with a lighted candle. It has air in it, otherwiſe the fiſh could not live in that element, nor plants grow. For it is neceſſary to the life of all animals, and the vegetation of all plants.

PRO-

PROPOSITION 2.

Air has Water, and Earth, and Fire in it.

DEMONSTRATION.

Air has water in it, otherwiſe the vegetation of plants could not be carried on, many of whom receive their nouriſhment by the ſtalk, or leaf, and are very ſucculent, although they are ſituated in the drieſt expoſure of walls and rocks *(c)*: And if it has water in it, it has alſo by propoſition 1. earth and fire.

It may alſo be proved abundantly that it has fire in it, by its being neceſſary to the ſupport of fire, which alſo is ever known to increaſe with the admiſſion of the freſh air, provided the quantity be not ſo great as to diſſipate the fewel.

PROPOSITION 3.

Earth has Water, Fire, and Air in it.

DEMONSTRATION.

The drieſt earth applied to fire will emit a vapour. But all vapour is water blown up into little bladders by air, and floating in it: Therefore earth has in it water and air. Conſequently by prop. 1 and 2. it

(*c*) See the deſcription of the arbutus growing on high rocks, without any appearance of earth, in the account of the lake near Killarny.

Mr. Hughes his account of one kind of the Anana is to this purpoſe, See Nat. Hiſt. of Barbados. *Caraguata*, or the large wild barren pine. This in propriety of language, ought to be looked upon as an aquatic plant, though ſuſpended in the air, among the branches of lofty trees, to whoſe boughs it is faſtened by its numerous roots, which ſerve not to ſuck, or draw from them any nutritious juices to further its growth, as the Miſletoe doth from the Orange tree &c. but only to be its ſupporter: Provident nature having in a very extraordinary manner, ſupplied this with other means to preſerve its ſpecies: For the leaves which reſemble thoſe of pine, but only larger, ſurround this plant in a circular manner, each leaf near the ſtalk terminating in a hollow bucket, which contains about half a pint of water. It is by theſe numerous ſmall reſervoirs of water, that the roots, as well as every other part of this plant, are ſupplied with nouriſhment, without the help of any earth. The flouriſhing condition of this, as well as the great growth of fig trees upon barren rocks, ſhews, that water is of greater uſe to vegetation than earth.

This author does not ſay, whether the water in the buckets of this plant is owing to rain, or to the attractive power of the plant collecting it from common air. Houſe Leek is a remarkable ſucculent plant, by the laſt method. See what Botaniſts ſay of the leaves of Aloes.

it has fire. But it may alſo be proved abundantly to have fire: Becauſe almoſt all hard earth will upon colliſion with other hard bodies emit fire. It may alſo be proved abundantly to have air, becauſe many hard and denſe bodies applied to fire, burſt with an exploſion: And if hard and denſe bodies contain air, a fortiori the more ſoft and porous do.

PROPOSITION 4.

Fire has Air, Water, and Earth in it.

DEMONSTRATION.

The great fountain of fire in this part of the univerſe, is the ſun; but the ſun is very well known by obſervers to be ſtained, and ſpotted by a ſcurf, which is thrown up over part of its ſurface; as in the caſe of all bodies liquified and agitated in an intenſe degree of heat. This condenſed ſcurf incruſting part of the ſurface may be called earth; at leaſt it is ſomething very diſtinct from pure elemental fire; and ſince it cannot be called water or air, which are diſſipable with heat, and in this caſe, one muſt be rarified to an immenſe degree of expanſion, and the other blown into vapours of immenſe tenuity, neither of which could become durable ſtains, it muſt be called earth: Unleſs a fifth denomination of elementary matter be introduced (*d*): But if the fountain of our fire be thus mixt, all derivations from it, in rays falling upon a globe of heterogene matter, and blended with it, muſt become more mixt;

(*d*) It is well known that it was the opinion of the ancient chemiſts, that fire, air, water, and earth, concur to the formation of bodies, but beſides theſe, they ſuppoſed farther, that there is another fifth principle, which being added to the compound ariſing from the combination of the former, gives every body that peculiar diſpoſition, on which principally depends the colour, ſmell, taſte and virtue, of ſuch a particular body. This therefore being ſuperadded to the other four eſſences, they called the (quinta eſſentia) quinteſſence of bodies. This they imagined to be contained in its body in an exceeding ſmall quantity, but at the ſame time to be vaſtly efficacious; and where it is ſeparated from it, to be fit to animate the ſpirits of ſome other body, into which it is infuſed. (Boerhave El. of Chem. part 3. proceſs 67.)

But it is not the deſign of theſe lectures to enter into a diſquiſition of ſo nice a point; which it may be extremely difficult if not impoſſible to ſettle; it ſuffices for the preſent purpoſe to demonſtrate that there are four different ſorts of matter in the univerſe. That

mixt; and conſequently as it conſorts with air, water, and earth, it muſt become airy, watry and earthy, as by Prop. 1, 2 and 3, Fire was proved to be in air, water, and earth.

COROLLARY 1.

From hence it follows, that all elementary bodies of this our globe, contain ſomething of the other elements in them, and they are diſtinguiſhed by the different names of elements only upon account of the greater abundance of a particular elemental matter in one than another. Water is called ſo, becauſe it contains a much greater quantity of true elemental water than of air, earth and fire, which it alſo contains in ſome proportion. Mix earth with water ſo as to give it that conſiſtence, which is called clammineſs, and it loſes its former denomination and takes that of ſlime; drie that clammy earth by means of the ſun or a culinary fire, and increaſe the fire till the earth is capable of continuing to burn by itſelf, then it loſes its former name, and is called fire; for the name is always attributed to the greater abundance of any elemental matter. Air may be ſo impregnated with water, as to be called water; and water may be ſo divided and expanded by air, as to be called air. Earth may be ſo diluted with water, as to be called water: And water may be ſo thickened with earth, as to be called earth: Fire may be ſo intangled with other matter, as to take the names of other matter, as phoſphorus &c. And that it is capable of being fixt, that is, in the vulgar ſenſe of things (For in truth all matter is in abſolute, and

That theſe four ſorts of matter are never found by human experiments totally ſeparated from each other, but in ſome degree mixt; and that each of them in theſe mixt ſtates, have certain peculiar qualities, and that an infinite variety of phænomena may ariſe from an infinite number of mixtures †, which theſe ſorts of matter are ſuſceptive of, from their capacity to admit of diviſion to infinite minuteneſs. Inſtead of a *quinta eſſentia*, we may allow the immediate ACTIVITY of the author of matter, and this will do as well, ſince human experiments can never reach that *quinta eſſentia* (if there be ſuch a thing) to diſcover its properties.

† Thoſe who have written de arte combinatoriâ reckon no fewer than one hundred ſeventy nine millions one thouſand and ſixty ſorts of earth. See Evelyn his treatiſe on earth. Kirchers his mundus ſubterraneus.

merely relative motion) the impregnating mercury with the rays of the ſun, ſo as thereby to increaſe the weight and make gold, is a proof; for which ſee the writings of *Homberg*, and Sir Kenelm Digby *(e)*.

COROLLARY 2.

All bodies of this our earth are mixtures of theſe four elements, and all diverſity of them ariſes from mixtures in divers proportions; and although the diverſity may appear to be infinite, an infinite number of proportions in which the elements may be mixt, may ſufficiently account for a variety of productions, although they are infinite. For if any two elements are to be mixt in all the variety of proportions poſſible, it may be conceived firſt, as 2 to 1. or 2, 3, 4, 5, 6, 7 to 1, and ſo on to infinity, or as $\frac{1}{10}$th to 1. or 01 . 001 . 0001 . 00001 . to 1, that is, by an infinite increaſe of one towards the other, or an infinite decreaſe of one towards the other. For it is well known to the geometrician, that the ſmalleſt portion of matter is capable of infinite diviſion (which ſhall be next demonſtrated) and thereby of holding infinite proportions to any other portion of matter, which is itſelf alſo capable of infinite diviſion. But if this be the caſe between any two elements, the variety of all proportions poſſible between four, muſt become infinitely greater, and conſequently the variety of bodies ariſing from theſe mixtures can not be limited or conceived by the human mind. By this is not meant a mechanical account of the order of things, which never can be given accurately. Becauſe HE, who made matter, is the Being who ſtill acts, and continues in every phænomenon the laws of motion. No more therefore is meant by this, than whereas that Being is pleaſed to create matter, and uſe its paſſive inſtrumentality in producing various phænomena; the four ſpecies of elementary matter may be ſo combined, according to the laws, which the author of matter has given them, as to exhibit an infinite variety of appearances.

PRO-

(e) I remember a rare experiment, that a nobleman of much ſincerity and a ſingular friend of mine, told me that he had ſeen, which was that by means of glaſſes made in a particular manner, and artificially placed, one by another, he had ſeen the ſun beams gathered together, and precipitated down into a browniſh or purpliſh red powder. There could be no fallacy in this operation when the glaſſes were placed and diſpoſed for this intent, and it muſt be in the hot time of the year, elſe the effect would not follow; and of this magiſtery he would gather ſometimes near two ounces in a day.

Kenelm Digby, of bodies. page. 63. Homberg has exceeded this.

PROPOSITION 5.

Matter is capable of diviſion to infinity.

DEMONSTRATION.

Since the infinite diviſibility of matter has been mentioned, as a neceſſary part of what preceded, and may be of great uſe in reſpect to what follows, it will be proper here to give a demonſtration of it. In this, and all other demonſtrations applied in theſe lectures as little of mathematics ſhall be uſed, as is poſſible: And this particular property of matter having been largely demonſtrated by Keil, in his introduction to natural Philoſophy, a ſhort demonſtration of it ſhall ſuffice in this place; there is no deſign oſtentatiouſly to exhibit mathematical literature, but only in a brief, and perhaps a new manner, to demonſtrate ſome propoſitions neceſſary to the main part of our reaſoning.

Suppoſe BC, DE, FG, HI in fig. 1. to be ſtrait lines parallel and equal to each other, and K a point which is the center of the circle BRCL, and of the exterior circles. It is plain that ſtraight lines may be drawn from B and C to K, and alſo from D and E, F and G, H and I, and from all poſſible lines parallel and equal to BC, and drawn beyond HI; that is, from an infinite number of lines: But it is alſo plain, that the lines which are drawn from DE fall between thoſe from B and C, and cut the line BC at M and N, and thoſe which are drawn from F and G fall between M and N and cut the line in points which are ſtill nearer, and ſo on to infinity; becauſe an infinite number of lines may be drawn, all parallel and equal to the firſt BC; that is, the line BC is capable of being divided into an infinite number of points.

The lines in the figure are drawn wide aſunder for diſtinction, but they may be conceived to be drawn extreamly cloſe, and inſtead of ſtraight lines, you may conceive BRC a ſmall portion of a circle BRCL, and BKN an angle at the center, and DSE a ſmall portion of a circle DSP, and FTG a ſmall portion of a circle FTQ, and the demonſtration will be the ſame as before, and the ſuperficial angle BKC will hereby be demonſtrated capable of infinite diviſion. Then ſuppoſe ſolid globes or

ſpheres (or ſolid bodies bounded by ſingular and angular ſurfaces) inſtead of theſe circles, and BRCK, DSEK &c. to denote ſolid portions or ſectors of thoſe ſpheres, or ſolid bodies bounded by ſimilar angular ſurfaces; and BKC a ſolid angle at the center, or a ſolid cone; and the demonſtration is ſtill ſimilar; becauſe there may be lines drawn to the center from the angular points, and all the points of the ſurfaces, removed at pleaſure to infinity and parallel, which will in like manner infinitely divide BKC the ſolid angle, or the ſolid cone &c. Matter therefore is capable of diviſion to infinity. Q. E. D.

Since the infinite diviſibility of matter has been demonſtrated, it will alſo be proper to demonſtrate the increaſe of the ſurfaces of all bodies, upon diviſion; for upon the truth of this depends the ſolution of many phænomena, concerning bodies, which may be made to ſwim in fluids ſpecifically lighter. Hence it is that not only water and earth floats in air, but alſo metals. As there may be frequent uſe made of this propoſition in what follows, and a demonſtration of it has not any where yet occurred, it will be proper here to give a full demonſtration of it. For the propoſition already demonſtrated by mathematicians, will not intirely anſwer our purpoſe, to wit, *by diviſion of regular ſolids, matter and gravity decreaſes in a triplicate ratio of the diameters; but the ſurface decreaſes only in a duplicate ratio of the diameters.* Our deſign is to demonſtrate, that every irregular ſection of a regular body, and the ſections of all bodies regular or irregular occaſion a great increaſe of the quantity of ſurface.

And firſt of the increaſe of ſurface in the diviſion of a cube or die; to demonſtrate which, the following lemma will be neceſſary.

LEMMA.

Let ABC fig. 2. be a die or cube bounded by ſix equal ſurfaces. Cut it through in lines equally diſtant from any two ſides in the ſame plain, ſo as to divide it into halves. It is evident that each half of the die has over and above the half of all the ſurfaces of the whole die, the additional ſurface, markt by the prickt line GHIK, which is equal to one ſurface of the whole die, or $\frac{1}{6}$ part of the entire ſurface. Divide the half

dice

dice as before equally, cutting them parallel to the ſmalleſt ſurfaces, and each half, that is, each fourth part of the whole die will have an additional ſurface RPQS, over and above the whole ſurface of the entire body of which it is an half, that is, $\frac{1}{12}$th part of the ſurface of the whole die, which is equal to one ſmall ſurface, or half a large ſurface of the half die: Divide the four parts as in fig. 3. by cutting them equally diſtant from the ſmalleſt ſurfaces, and each half thereof will have the additional ſurface markt FGH, over and above the half of the whole ſurface of that intire body, of which it is half, that is, $\frac{1}{24}$th part of the ſurface of the whole die. Therefore each eighth part of the large die, will become a ſmall die, having ſix ſurfaces all equal. By continuing to divide the ſmall dice or cubes, the ſame proportions of the increaſe of ſurface will be continued infinitely; that is, the aditional ſurfaces conſidered collectively, as parts of the ſurface of the large die, and belonging to all the bodies in the diviſion are $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$, $\frac{4}{3}$, &c. infinitely. For every ſection paſſing through the intire thickneſs of the die, and being parallel to one of the ſurfaces, occaſions an addition of two ſurfaces, each equal to one of the ſix ſurfaces of the large die, that is; $\frac{1}{6}$th part of all the ſurface, and the two make $\frac{1}{3}$.

But if the bodies are taken ſingly, and their ſurfaces conſidered as parts of the intire ſurface of the large die, belonging to each ſeparately in the diviſion, the additional proportions of them may be expreſt by the following fractions $\frac{1}{5}$, $\frac{1}{12}$, $\frac{1}{12}$. $\frac{1}{12}$, $\frac{1}{24}$, $\frac{1}{24}$. $\frac{1}{24}$, $\frac{1}{48}$, $\frac{1}{48}$, &c. infinitely, i. e. Upon the firſt ſection of the die, each half acquires an increaſe of $\frac{1}{6}$th part of the whole ſurface, over and above half the whole ſurface; upon the diviſion of the half dice again, each quarter acquires $\frac{1}{12}$th part of the intire ſurface of the whole die, over and above $\frac{1}{2}$ of the intire ſurface of the half die. Let therefore the firſt column A denote the matter of the cube or die, and its parts by diviſion, and the column C ſhall denote the increaſe of ſurface over and above that which is proportional to the matter, in the column B.

A	B	C
The die or cube has	6 plains	
divided 1	$\frac{1}{2}$	$\frac{1}{8}$ more than $\frac{1}{4}$
2	$\frac{1}{4}$	$\frac{1}{32}$ more than $\frac{1}{4}$
3	$\frac{1}{8}$	$\frac{1}{128}$ more than $\frac{1}{8}$
&c.		

A die may be divided by continual ſections, into other dice of different magnitudes. By 3 ſections it may be divided into 8 ſmaller dice, which for diſtinction's ſake, we will call dice of the firſt order, being the firſt that ariſe from diviſion. By 6 ſections it may be divided into 64 dice of the ſecond order. By 21 ſections it may be divided into 512 dice of the third order, and thus to be continued infinitely.

From hence the proportion of the increaſe of ſurfaces upon diviſion, may be eſtimated.

PROPOSITION 6.

All the ſurfaces of the 8 ſmall dice, which ariſe from the firſt diviſion, and are of the firſt order, make twice the intire ſurface of the great die.

DEMONSTATION.

Each ſmall die of the firſt order, has $\frac{1}{4}$th the intire ſurface of the great die. For by the proportions laid down above, it appears that one of its ſurfaces is $\frac{1}{32}$th part of the intire ſurface of the great die, but $\frac{1}{32}$th part taken ſix times makes $\frac{1}{4}$th, or twice the intire ſurface of the large die. Q. E. D.

Although there might be ſeveral propoſitions in the manner of the foregoing one, in conſequence of the lemma, concerning the increaſe of ſurface by the diviſion of regular cubes, yet it was deemed more elegant and ſuccinct to give the following problem and its ſolution, in lieu of them all.

PROBLEM.

PROBLEM.

To find the proportion of ſurface upon the diviſion of a cube or die, in the ſeveral orders, as above noted in the lemma, firſt, ſecond, third, &c.

SOLUTION.

Divide the cube or die, according to the lemma, and it appears, that the number of dice increaſe in a triplicate proportion 1 8 64 512
But the ſurface of each die decreaſes in a duplicate proportion 1 $\frac{1}{4}$ $\frac{1}{16}$ $\frac{1}{64}$

Now by multiplying the number of dice in each diviſion, by the ſurface of each ſingle die in that correſpondent diviſion, you will get the ſum of the ſurfaces of all the dice, in the ſeveral reſpective diviſions, thus,

$1 \times 1 =$ ſurface of the large die
$8 \times \frac{1}{4} = 2 =$ ſurfaces of all the dice of 1ſt order.
$64 \times \frac{1}{16} = 4 =$ ſurfaces of all the dice of 2d order.
$512 \times \frac{1}{64} = 8 =$ ſurfaces of all the dice of 3d order.

So that upon this kind of diviſion of any one regular body, into other ſimilar bodies of the ſame kind ſucceſſively, the whole ſurfaces or ſum of them will bear this proportion to each other — 1 : 2 : 4 : 8 : 16 &c.

The proportion of ſurface in all kinds of ſections parallel, may be eſtimated in the following manner.

If the whole ſurface of the large cube be $= 1 = 1$
Upon a diviſion into two pieces, the increaſe of ſurface $= \frac{2}{6} = \frac{1}{3}$
Upon a diviſion into four pieces, the increaſe of ſurface $= 1\frac{4}{12} = \frac{1}{3}$
Upon a diviſion into eight pieces, or eight ſimilar cubes $= 2\frac{8}{24} = \frac{1}{3}$
Now $1 + \frac{2}{6} + 1\frac{4}{12} + \frac{8}{24} = 2$

Let us now conſider the increaſe of ſurface, in the ſection of a ſphere. ABCD Fig. 4. is a ſphere; and a plain paſſes through it, in the diameter CD which divides it into two hemiſpheres.

PRO-

PROPOSITION 7.

The increaſe of ſurface in each hemiſphere is $\frac{1}{4}$th of the ſpherical ſurface, and in two hemiſpheres $\frac{1}{2}$ of the ſpherical ſurface.

DEMONSTRATION.

The ſurface of every ſphere is four times its largeſt circle, *(e)*, therefore the large circle EFDG being taken twice, (for it belongs to each hemiſphere) is $\frac{2}{4}$ths or $\frac{1}{2}$ the ſurface of the ſphere. Q. E. D.

COROLLARY.

The numbers expreſſing the increaſe of ſurface, by continual ſections through the center are $\frac{1}{2}, \frac{2}{2}, \frac{3}{3}, \frac{4}{2}, \frac{5}{2}, \frac{6}{2}$ therefore every two ſections give an increaſe of ſurface, equal to the whole ſpherical ſurface, and after 2000 ſections, the aggregate of all the ſurfaces is 1001 times the ſpherical ſurface.

We will next conſider the increaſe of the quantity of ſurface in the ſection of a cylinder.

Fig. 5. ABCD is a cylinder, whoſe ſide AB is equal to the diameter of the baſe BC, that is, which is as high as broad; and it is cut by a plain parallel to the baſe EFGH.

PROPOSITION 8.

Every ſection of ſuch cylinder increaſes the ſurface by $\frac{1}{3}$d of the firſt intire ſurface.

DEMONSTRATION.

The ſurface EFGH is $\frac{1}{4}$th part of the convex ſurface ABCD *(f)*, and it is equal to the top, which is equal to the baſe, therefore the ſurface

(e) Theorc. Selec. ex Archimede. Prop. 24.
(f) Corol. to 12. The. ex Archimede.

ſurface EFGH is $\frac{1}{6}$ part of the intire ſurface of the cylinder; but EFGH belonging to each half cylinder muſt be taken twice, which will be $\frac{2}{6}$th or $\frac{1}{3}$d of the whole ſurface. Therefore the increaſe is $\frac{1}{3}$d of the firſt intire ſurface.

COROLLARY 1.

If the ſections be continued, the increaſe of ſurface may be expreſt by the following numbers, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$, $\frac{4}{3}$, $\frac{5}{3}$, $\frac{6}{3}$, $\frac{7}{3}$, &c. infinitely. Therefore by three ſections the intire ſurface is doubled, by three more it is tripled &c. that is, every three ſections is an addition of ſurface, equal to the firſt intire ſurface, and after 3000 ſections, the aggregate of all the ſurfaces will be 1001 times the firſt intire ſurface.

COROLLARY 2.

In every cylinder of other dimenſions, every ſection of this kind occaſions an addition of ſurface equal to the ſum of the ſurfaces of the top and the baſe of the cylinder, which, if in ſome caſes it be leſs than $\frac{1}{3}$ the curve ſurface, in others may be much more.

Whatever the dimenſions of the cylinder are, the increaſe of ſurface, may be eſtimated as above in the cylinder of equal height and breadth. For if an high cylinder may be divided into many cylinders of equal height and breadth, in that caſe, the proportions of all the ſurfaces ariſing from ſections, bear the ſame proportion to the intire ſurface before ſection, as the increaſe of ſurface after one ſection, to the intire ſurface of one before ſection. If the cylinder be lower than broad, it may be conſidered, as ſuch a part of one which is as high as broad, that the proportion may be eaſily aſcertained. If the height be $\frac{1}{4}$th of the breadth, every ſection gives two ſurfaces, each of which is equal to the convex ſurface; in this caſe, the increaſe of ſurface is by continual ſection as 2, 4, 6, 8, 10, 12, &c. And fifty ſections will give for the aggregate of all the ſurfaces 103 times the curve ſurface.

Fig. 6. Let RDEM, a cylinder, be cut unequally in A, B, C, parallel to the baſe, that DC may be equal to CB, and BA to $\frac{1}{4}$th of CB or $\frac{1}{8}$ of DB and RA to $\frac{1}{2}$ of BA or $\frac{1}{19}$ of RD.

Every ſection in the cylinder RDEM, is equal to ½ the convex ſurface CDEF, or ¼ of twice that, BDE, or bears the ſame proportion to ADEH as 1.77 &c, to 9, or to RDEM as 2 to 9.35 &c.

Thus it is eaſy to determine the increaſe of ſurface in cylinders, whoſe diameters and heights are unequal.

PROPOSITION 9.

Now ſuppoſe the cylinder to be cut downward from the top to the baſe, through parallel diameters of each AD, BC. Fig. 5.

The increaſe of ſurface by every ſection of this kind will be ſomething more than ⅔ds of the convex ſurface.

DEMONSTRATION.

By this kind of ſection two equal ſurfaces are made, ABCD, one belonging to each half of the cylinder: And the convex ſurface is equal to the rectangle AB into BFCG, i. e. *(h)* the height of the cylinder into the periphery of the baſe, and the ſurface ABCD is equal to the rectangle AB into BC. i. e. the ſide of the cylinder into the diameter of the baſe. But BC the diameter is ſomething leſs than ⅓d *(i)* of BFCG the periphery; it is pretty nearly as 7 to 22. conſequently the rectangle or plain ſurface ABCD is ſomething leſs than ⅓ of the convex ſurface ABGCDH; and the plain ſurface taken twice (For it belongs to the two parts of the cylinder) is leſs than ⅔ds. If the numbers expreſſing the increaſe of ſurface be ⅔, ⅘, ⅚, ⅞, ⅒, &c. there is an omiſſion of a difference nearly of ⅐ths, which upon four diviſions will make ſomething more than a whole convex ſurface, and upon three diviſions ſomething leſs. And it is hitherto impoſſible to expreſs the proportion accurately, becauſe the proportion between the periphery of a circle and the diameter, which is the foundation of this proportion, can not be accurately fixt by the greateſt geometricians. Yet as much, as we intend, is hereby fairly demonſtrated, to wit, a great increaſe of ſurface: For four ſections give more than twice the curve ſurface as an increaſe.

The ſection of the cone remains to be conſidered. Suppoſe fig. 5. LBC an upright cone upon the ſame baſe, and of the ſame height of the cylinder,

(*h*) Theor. ex Archimede. Prop. 11. (*i*) Theor. ex Archimede. Prop. 6.

cylinder, and cut from the vertex L perpendicular to the baſe, ſo as to make two triangular ſurfaces LBC, one belonging to each half of the cone.

PROPOSITION 10.

The increaſe of ſurface by ſuch ſections as theſe, is exactly the ſame in reſpect to the convex conical ſurface, as in the former ſection of the cylinder, the quantity of ſurface generated being half the convex conical ſurface.

DEMONSTRATION.

The triangular ſurface LBC is half the rectangular ſurface ABCD. And the conical ſurface is half the cylindrical convex ſurface: But the proportion of half to half, is the ſame with that of the whole to the whole.——Therefore the increaſe of the ſurface is the ſame in proportion as in the former ſection, and the quantity of ſurface generated by the ſection of the cone, is half the quantity of the ſurface generated by the ſection of the cylinder.

GENERAL SCHOLIUM.

Thus may a great increaſe of ſurface be demonſtrated in the ſections of a cube, ſphere, cylinder, and cone; and in as much as all maſſes of matter however irregular in their ſhapes, may be conceived to conſiſt of exceeding ſmall portions of matter of ſome or all theſe figures, at leaſt approaching ſo near to them, as not to occaſion any difference in the reaſoning, (*k*) concerning them; the poſition therefore may be true of all matter; that upon diviſion there ariſes a conſiderable increaſe of ſurface, that is, an infinite quantity of ſurface, the conſequence of an infinite diviſion.

The concluſion of the whole is, that matter as it decreaſes in quantity, increaſes in ſurface, and as it increaſes in quantity, it decreaſes in ſurface, and this differently in different figured bodies, but greatly in all; and in all regular bodies the decreaſe of gravity or matter upon di-

(*k*) The whole globe may be conſidered as a perfect ſphere, notwithſtanding its vallies and mountanous parts, and the flatneſs at the poles; and ſome phyſical propoſitions may be demonſtrated upon that ſuppoſition, whoſe truth is not invalidated by thoſe ſmall circumſtances.

viſion, is in a triplicate ratio of the diameters or ſides, but the decreaſe of ſurface only in a duplicate ratio. For gravity is according to the quantity of matter or ſolid content; and that decreaſes in all regular bodies in a triplicate ratio of the diameters or ſides, by Euclid, lib. 12. Sch. Prop. 18. and the decreaſe of ſurface in a duplicate ratio of the ſame follows from Corollary to Prop. 20. lib. 6. Eucl.

But it ſhould be obſerved, that when matter is demonſtrated to be capable of diviſion to infinity, and conſequently of increaſing the ſurface infinitely in proportion to the diminution of the quantity of matter; this does not hinder the acknowledging the exiſtence of extreme hard portions of matter, which by any action of matter upon matter, are incapable of being divided, or of having the form any way altered: For it is exceeding probable, that all matter conſiſts of ſuch; and the probability of this ariſes in a great meaſure, from the very property already demonſtrated. For the coheſion of matter is according to the number of points in contact, and therefore the ſtrongeſt coheſion is between the ſmalleſt particles, becauſe they having the largeſt proportional ſurfaces, are capable of touching in moſt points; conſequently there muſt be in nature particles of matter ſo cloſely adhering to others, that no finite force can ſeparate them: But theſe are the ſmalleſt portions of matter; many of the larger maſſes being capable of an eaſy diviſion: As in the common phænomena of ſlackt lime: When lime is firſt brought out of the kiln it is in the form of ſtone, which by means of water crumbles with a violent ebullition into a very fine powder; and whereas in the former ſtate it was conſiderably weighty, being contained in a ſmall ſpace and incapable of being blown about by the wind, yet being reduced to powder, it increaſes in meaſure at leaſt one third of the whole content, and is eaſily born up into the air and diſperſed by its motion. It is perhaps the great degree of ſmallneſs to which it is reduced, which renders it ſo excellent a cement with other matter, the ſtrongeſt attraction being between the ſmalleſt particles.

The great uſes of theſe properties of matter, and the neceſſity for them will appear in the following lectures; particularly in the frequent reference to them for accounting for the riſing of bodies in fluids ſpecifically lighter: ſuch as gold and other metals in water and air. For theſe bodies being reduced to exceeding ſmall parts, acquire a vaſt quantity of ſurface in reſpect to the ſmall quantity of matter: And al-

though

though they are ſpecifically heavier, they do not always make the fluids in which they ſwim, ſpecifically heavier than the homogene fluid, to which it may be compared. For the honourable Mr. Boyle tells us, that *Mineral waters are ſometimes lighter than common water (l)*.

Now without having recourſe to ſuppoſitions, whether well or ill founded, ſuch as a probability of original porous particles let us conſider the nature and manner of fluids acting upon ſolids, ſo as to raiſe them, and a ſhort remark upon that will clear this matter, which otherwiſe may ſeem to have difficulties. 'Fluids preſs upon bodies, to which they are contiguous, eve-
' ry way, and on all ſides, but the preſſure upon each part is not the ſame;
' the altitude of the fluid is every where the meaſure of its force; and
' the ſeveral parts of the ſame body being at different depths, muſt needs
' be differently affected. We ought therefore to conſider, which of all
' theſe impreſſions will prevail. Now it is evident, that the lateral preſ-
' ſures do all ballance each other, being equal, as ariſing from equal al-
' titudes of the fluid, and oppoſite in their directions; ſo that from theſe
' the body is no way determined to any motion. But thoſe parts of the
' fluid which are contiguous to the under ſurface have a greater altitude,
' and therefore a greater force, than the others, which are contiguous
' to the upper; therefore the body muſt of neceſſity be more violently
' elevated by the former, than depreſſed by the latter, and would there-
' fore aſcend by the exceſs of force, was it devoid of gravity. Now it
' is eaſy to underſtand, that this exceſs of force is equivalent to the
' weight of ſo much of the fluid, as is equal in magnitude to the bulk of
' the body, being the difference in weight of two columns of the fluid,
' whereof one reaches to the upper, the other to the under ſurface of
' the body.

Now ſuppoſe any maſs of matter reduced to very ſmall parts by diviſion: Theſe parts (in as much as matter is capable of infinite diviſion) may be conceived ſo ſmall *(m)*, that their ſurface is exceeding great, in reſpect to the quantity of matter contained in them, that is, their abſolute weight; conſequently

(l) Partly becauſe they are impregnated with volatile parts, and partly becauſe they are void of ſaline parts, which make common water ſomething heavier.
Boyle abridged by Boulton, vol. I. p. 290.

(m) I have tried that half a grain of marchaſite, diſſolved in ſpirit of nitre, communicated a tincture to 61440 parts of water, tho' part of that marchaſite was ſulphur, and part of it caput mortuum. Boyle abridged by Boulton, Vol. I. p. 299.

conſequently in a fluid the difference between the ſhorter column which preſſes them down, and the longer column which preſſes them up, is exceeding great in reſpect to their gravity, which becomes inconſiderable, therefore the particles muſt riſe in the fluid.

If it ſhould be alledged in oppoſition to this demonſtration, (For even mathematics is liable in ſome caſes to the appearance of contradictory demonſtrations) that the ſpecific weight of any body, being as its denſity, when it is commiuted, every ſmall portion will ſtill be proportionably weighty; and therefore if a cubic inch of gold, is heavier than a cubic inch of water, ſo will the cubic inch of a third order of that cube of gold be heavier than a cube of the ſame order of water; and ſo on to infinity. To this may be anſwered; the ſolution of all phænomena in nature muſt at laſt end in miracle, and the Divine FIAT can alone account for the laſt appearance. However in this caſe ſomething may be ſaid without going beyond ſecond cauſes.

The *weight* of bodies depends upon the quantity of matter, and the *ſpecific weight* upon the quantity within equal ſurfaces. But the kinds of pores, (for all bodies have pores,) may be very different. Gold is ſpecifically heavier than ſilver: But the whole void ſpace or the aggregate of all its large pores, is not equal to the whole void ſpace, which will ariſe from the aggregate of all the ſmaller pores of ſilver. We may therefore ſuppoſe ſuch matter compounded in ſuch a manner, as to anſwer the phænomena of riſing in fluids, when reduced to ſmall parts, which deſcends, when it is in groſs maſſes; for the very ſmall particles may be extreamly porous, and there may be within them again, ſmaller and more porous particles; till at laſt you come at original indiſcerptible and perhaps imporous particles. When gold is divided into the firſt kind of ſmaller particles, it may ſwim in water, when into the ſecond which are ſmaller, it may ſwim in air, when into a third which is ſtill ſmaller, it may perhaps float in the vacuum of Boyle: And yet a maſs of this matter may be ſpecifically heavier than any known body. To illuſtrate this, imagine very ſmall hollow cubes of gold, imagine wool, or any light ſubſtance, and each cube lighter than ſo much water thruſt into them, theſe may be fitted together ſo as to make a maſs of matter which ſhall outweigh an equal bulk of water.

If it ſhould ſtill be contended that this gravity of the ſmall particles is ſomething, and of moment, and ſhould hinder the effect. It may be further anſwered, that the gravity is certainly ſomething, yet of no moment

ment in the phænomena; and therefore ſhould not be rated upon account of the more conſiderable effect, owing to the increaſe of ſurface. For if theſe extreme minute forces are not thrown out of account, hardly any phænomenon can be explained; the ſecond cauſes of things ſeeming ſo frequently to interfere with each other, that without the neglect of ſome, which have the leaſt ſhare in producing or retarding an effect, our reaſoning upon things would be ſo embaraſſed that a very ſhort progreſs could be made in natural things. And of this the hydroſtatical rule of Archimedes, is a very remarkable inſtance and cloſe to our purpoſe.

" For if we ſhould be ſcrupulouſly exact we may eaſily correct a ſmall " error in the rule, namely, that the part immerſed in any fluid is to the " whole, as the gravity of the ſolid to the gravity of the fluid.

" For ſince the air is an heavy fluid, tho' it be perhaps the leaſt heavy " of all others; yet by reſting upon the body it has this effect, that in " reality it will not admit a ſolid to be altogether ſo deeply immerſed, " as it would otherwiſe be, if the air were removed, which the rule " ſuppoſes: Allowing then for the air's preſence, we may thus ex- " preſs the proportion: That the part immerſed is to the whole, as the " difference in weight of the ſolid and an equal bulk of air, is to the " difference in weight of an equal bulk of the fluid, and the ſame equal " bulk of air. Whoſoever will compare theſe two rules together, will " find, that their difference is altogether inconſiderable: We may there- " fore ſtill make uſe of the old one without any further ſcruple."

Thus reaſons the judicious COTES.

In like manner the gravity of exceeding ſmall particles of gold is *ſomething*, yet of ſo little moment as not to hinder the riſing of very ſmall particles of heavy bodies in light fluids, upon account of the greatneſs of the ſurface.

To all this may be added, one circumſtance more of conſiderable importance to fluids, to inable them to ſupport bodies ſpecifically heavier, and that is, their clammineſs and tenacity: A ſmall needle of ſteel ſhall ſwim upon the ſurface of water, ſo long as the upper part of the needle remains dry, the fluid being quieſcent; and many other things will float in the ſame manner: ſmall particles of matter likewiſe ſpecifically heavier than water may ſwim in oil, which itſelf is ſpecifically lighter than water. Beverage prepared for the uſe of man, ſhall be extremely clear, and upon a little agitation of the veſſel be ſo diſcoloured, as to require weeks and months to be clarified by a ſubſidence of the heterogene matter; tho' that matter be ſpecifically heavier, and in many caſes by that principle

principle at laſt ſubſides; yet the tenacity of the fluid ſhall detain it a long time, perhaps for ſome years, as may appear from inſtances mentioned in other parts of theſe Lectures. And further add to all this MOTION, and the ability of fluids to ſupport ſpecifically heavier bodies is ſtill increaſed, as well as the ability to immerge light bodies: By this it is, that duſt in windy weather is raiſed in the air, that mud floats in rivers and lakes, and hereby many phænomena of extraordinary conſequence are occaſioned.

In this lecture have been conſidered and demonſtrated, two univerſal properties of matter, and the diſtinction of matter into four elements, and the compoſition of each. In the following lecture, the properties of each element ſhall be more particularly conſidered and demonſtrated, and the phænomena which ſhall make the foundation of reaſoning, ſhall be rather thoſe of the common than the rare kind: For although *rarity* ſtrikes the mind more, yet it *informs* it leſs. When this ſhall be done, as is hoped, with a good degree of ſatisfaction; ſome phænomena of the rare kind ſhall be laid before you, and the laws of matter previouſly demonſtrated ſhall be applied to them.

Having thus finiſhed the mathematical part of our deſign, which tho' not of the marrow, but rather the ſurface of that ſcience, is fitter for a reader than a hearer; as indeed every thing in that ſcience is; a favour muſt be requeſted of all thoſe, who peruſe theſe matters with attention, not to reject the truth or cenſure the whole, if any error in the numbers &c. may have ſlipt from the pen. Great men have erred, and the main tendency of their writings has not been deſtroyed thereby. The ingenious Borelli thought he had demonſtrated, the force of the heart to protrude the blood, to be equal to 180000lb. Yet the accurate James Keil has ſince demonſtrated that the force of 1lb. will protrude 100lb. of blood. 'A Borello quidem ponderi 180000 librarum æqualis in corde 'vis, quæ viginti libras ſanguinis moveret, deſiderabatur: Sed ex ſupra 'demonſtratis patet, centum libras ſanguinis, à vi cordis non unam libram 'excedente, moveri poſſe. Hoc nonnullis aut procul intuentibus, aut 'parum cogitantibus mirum fortaſſe videri poteſt; quod ſi hanc rem 'propriùs et penitiùs inſpiciamus, nihil huic vi cordis attributum in-'veniemus, quod non abunde poteſt præſtare.' Keil Tent. med.

In the ſame manner, others have erred, and yet preſerve an eminent fame: That therefore which the moſt ingenious can not avoid, is pardonable in all.

THE

THE

Popular Elemental Lecture,

OR THE

PROPERTIES

OF THE

Four ELEMENTS,

ENUMERATED and PROVED,

Principally from the moſt obvious

PHÆNOMENA.

LECTURE II.

Nature has an univerſal principle for each claſs of things, and therefore the contemplation of all natural things conduces to the knowledge of a particular one; ſo, from a ſcientifical knowledge of any one, does follow the ſame of all and every one. See Hook his deſcription of experiments on Lignum Foſſile, page 106.

No man can advantageouſly diſcover the nature of any thing, in that thing itſelf, but the INQUIRY muſt be extended to matters that are more common.

Lord Verulam his new Machine. Aph. 70.

LECTURE II.

IN the former lecture, the four elements having been conſidered as *mixt bodies*; in this, the properties of each ſhall be particularly laid down, upon the ſame conſideration of their being *mixt bodies*. And the phænomena applied to this purpoſe, ſhall be for the moſt part ſuch as are moſt commonly to be obſerved, meaning to treat the ſubject popularly; yet with ſtrict regard to truth in the laws of Nature: And whereas our deſign is to haſten to the main purpoſe, to wit, the application of demonſtrated properties of matter, to particular phænomena, the demonſtrations ſhall be as ſhort, but as clear as poſſible.

The element which ſeems to have the neareſt relation to animal and vegetable life, ſhall be firſt treated of.

AIR is an elaſtic fluid, incompaſſing this globe of earth, and pervading it, capable of a great degree of expanſion and condenſation, and of a great increaſe of elaſticity and diminution of it. It is a principle of the preſervation of life in all living animals and vegetables, and a principle of putrefaction and corruption in them, when they are dead. It abounds with all ſorts of matter, and holds perpetual commerce with this our globe, in receiving exhalations pregnant with particles of various kinds, and forming *dew*, *rain*, *hail*, *froſt and ſnow*.

It will be proper to treat theſe in diſtinct propoſitions.

PROPOSITION I.

Air is an elaſtic fluid capable of a great degree of expanſion and condenſation, and of a great increaſe of elaſticity and diminution of it.

DEMONSTRATION.

Air ſuddenly expanded by the means of gunpowder fired, is capable of giving a vaſt force to engins of war; and fire in the bowels of the earth ſhall ſo rarify it, that it ſhall produce earthquakes, burſt the ſurface, and throw out immenſe quantities of matter with ſuch rumbling ſounds, as terrify mankind. Animals ſuddenly immerſed in water to great depths, by means of diving bells, ſhall be compreſſed to death by the condenſation of the air ſurrounding them; and if they be gradually immerſed ſo as to take in the denſe air without deſtruction, and be ſuddenly raiſed to the thin atmoſphere above the water, they ſhall burſt by means of the denſe air within expanding itſelf. The deſtruction, or even diminution of the elaſticity of the air, is not obſerved in the ſedentary air ſometimes found in vaults, and large oyl jars, which have been many years empty of oyl, and lie in cloſe places; nor in ſome kinds of damps in mines, although they are known to deſtroy life, and extinguiſh fire, as air paſſing through a tube from one fire to another will extinguiſh it, and air paſſing through the lungs of any animal, becomes unfit for reſpiration. In public aſſemblies where there is not allowed a free paſſage for the air, the air that is confined having been once breathed, will extinguiſh the candles, occaſion fainting, and the hazard of life.

All thoſe phænomena are not owing to the diminution of the elaſticity of the air. For by experiment ſuch air has been found equally elaſtic with wholſome air. There is therefore ſome other quality neceſſary to be found in air, in order to preſerve life and fire, beſides elaſticity; but in this propoſition, we are to conſider only the increaſe and diminution of elaſticity in that element. By condenſing air, it is rendered more elaſtic, and by thinning, leſs ſo; yet the action of thinning, ſhall produce the ſame effect with that of condenſation in ſome inſtances, and be of equal force. A ball may be diſcharged from a gun, by means of air condenſed by an engin for that purpoſe, with equal force with a ball diſcharged by rarified air, ariſing from inflamed gunpowder. Yet when air is once expanded by heat, and any quantity of it poſſeſſing a certain ſpace, is compared with that of condenſed air, poſſeſſing an equal ſpace, the former

ſhall

ſhall be leſs elaſtic than the latter, and that in proportion to the comparative degrees of denſity. They who climb to the tops of high mountains, find in breathing a ſenſible diminution of elaſticity, denſity or weight of air (which are always proportional) and as they deſcend, a ſenſible increaſe.

Air ſeems to be capable of elaſticity in proportion to reſiſtance: In ſo much that a ſmall quantity of it rarified in a gun barrel, is not only capable of burſting it; but if the globe of earth incompaſſed it without any aperture, when it is in a ſtate of rarification, that is, of exerting its elaſticity, it would burſt that alſo; although it ſhould immediately return to its former ſpace, the cauſe ceaſing to act which excited it to expanſion; hence all the dreadful phænomena of earthquakes, well known in ſome parts of the world.

PROPOSITION 2.

Air incompaſſeth this globe of earth and pervades it.

DEMONSTRATION.

This property neceſſarily follows from the demonſtration of the former. For the phænomena of gunpowder could not happen beyond the ſurface of the earth, without an external air, nor thoſe of earthquakes without an internal air.

PROPOSITION 3.

Air is a principle of preſervation of life in all living animals and vegetables, and a principle of putrefaction and corruption in them when they are dead.

DEMONSTRATION.

In as much as the circulation of blood in animals, and the motion at leaſt, if not the circulation of juice in the plants, is abſolutely neceſſary to life in all. Air is alſo neceſſary to life and a principle of it; for it is

a principle

a principle of thoſe; that is, air in a ſound ſtate: For ſtagnant, or non elaſtic air has been ſhewn in the former demonſtration to be deſtructive of life. Elaſtic air entring the human body by inſpiration, is expanded by the heat of the body, and thereby gives motion to the blood, and having done its office is expired, and freſh elaſtic air ſucceeding repeats the impreſſion by its ſpringy quality, and preſerves that miracle of perpetual motion (*n*): Miracle, I ſay, becauſe the blood moves even contrary to mechanic laws, and flows up the perpendicular height of the body: Whereas the nature of all fluids is to deſcend by the force of gravity. This, together with a vivifying ſpirit, the concomitant of wholeſome air, preſerves the animal life.

Mr. Boyle expreſſes his ſentiments in the following manner. 'I 'think that the neceſſity of the air's preſence to preſerve and continue 'flame, is a ſufficient argument of ſome latent ſpirit or quality, whether vi-'tal ſubſtance or nitrous ſpirit diffuſed through the air, on which likewiſe 'the life of animals depends, and without which, they as well as flame, 'preſently are extinguiſht and die.

'The air ſeems to be a ſubſtance capable of being aſſimilated by every 'body, or it conſiſts of all ſorts of ſeminal corpuſcles: So that any body 'may find a ſubſtance there, analogous to it, and fit to make up a part of 'the ſame body (*o*).

Air is a principle of the vegetation of plants alſo, being in many reſpects neceſſary to their growth. It enters the roots along with the moiſture of the earth, and being rarefied by the ſolar, or ſubterraneous heat, it promotes the motion of the ſap upward, and carries off the ſuperfluity of it in the form of vapour at the leaves. For air mixing with water, and rarefying it, whilſt it is rarefied itſelf by heat, can increaſe the ſurface of little congeries of water, ſo as to form bubbles,

(*n*) The head, heart, arteries, veins, and nerves, ſhould be formed at the ſame time, which can never be done by the motion of any fluid, what way ſoever moved: For the heart can not move, unleſs animal ſpirits be ſent from the head through the nerves into it. The animal ſpirits can not be derived into the heart, unleſs the blood be ſqueezed by the heart, through the arteries into the brain; ſo that it is evident, the head and heart, the arteries, veins and nerves, muſt all be formed at the ſame inſtant, and not ſucceſſively. But this is altogether impoſſible by the laws of mechanics: For no motion of any fluid, or fluids howſoever diſpoſed, can form all theſe at the ſame time, and we know all the internal mechanical actions of animals, are performed by the force of their circulating fluids.

Pitcairn and Porterfield's argument.

(*o*) Boyle abridged by Boulton, Vol. II. p. 304.

bles or vapours, which thereby riſe as effectually, as if the abſolute gravity of water was leſſened.

Air has alſo by its capacity of being condenſed, whilſt it is in the action of obtruding the ſap, upward, and laterally, to the growth and increaſe of the plant, unites itſelf ſo cloſely with many parts of the plant, as to become the fixt ſubſtance of it; and holds no further commerce with its own active element, being tied to ſluggiſh parts of matter, till putrefaction or ſome chemical proceſs diſengages it, and ſets it at liberty. For this air, which in the progreſs of the growth of animal and vegetable bodies, becomes conſtituent parts of them, will by means of heat ſeparate itſelf in a ſtate of death; occaſion a motion, fermentation, and at laſt diſruption of all the other parts, which is called putrefaction; and theſe parts ſhall thereby be carried off into the atmoſphere, and render it offenſive and unwholſome to living animals; hence it is that famines often produce plagues.

PROPOSITION 4.

Air is prædatory and corrodes all inanimate ſubſtances.

DEMONSTRATION.

The ragged appearance of ancient buildings, whether of marble or freeſtone, and the ruſt of the hardeſt metals ſufficiently demonſtrate this. Perhaps there may be one exception only of all ſorts of matter to this. Gold is not capable of being diſſolved by any thing, except ſea ſalt, or ſome menſtruum prepared from it. Hence it comes to paſs, that it never ruſts; for there is no ſuch thing as aqua regia, or ſpirit of ſea ſalt in the air, as the chemiſts ſay. Yet gold may be in ſome circumſtances ſo intangled with other matter, particularly with mercury, as to become volatile and flie up into the air. This is very ſurprizing that a mixture or union, of the two heavieſt bodies in nature, ſhould become capable of ſuſpenſion in the lighteſt fluid. But this is no more than a fair conſequence, from what has been demonſtrated already in the firſt lecture, of the great increaſe of ſurface by the diviſion of matter: For the heavieſt body may be reduced to ſuch ſmall parts, as to become more capable of ſuſpenſion in a fluid than any other, not ſo minutely divided.

PRO-

PROPOSITION 5.

Air abounds with all ſorts of matter.

DEMONSTRATION.

Since it is perpetually preying upon all the ſeeming fixt ſubſtances of the globe, by raiſing inteſtine motions in them, and carrying off conſiderable ſpoils by putrefaction and corroſion, and having no ſtore houſes for the reception of all this matter, except the open atmoſphere; that atmoſphere muſt abound with the minute particles, of all ſorts of matter; and that in very different proportions in different places, according to divers ſtrata of matter to be found in divers places of the ſurface of the globe; and according to different influences of the ſun in ſeveral climates and ſeaſons. Some countries and ſome ſeaſons ſhall be remarkable for thunder and meteors, and dews; others for little of thoſe, and abundance of rain. Some for froſt and ſnow, ſome for long druth and fragrant ſmells in the air, owing to the ſpices and aromatic plants; and ſome particular places for poiſonous air, owing to the effluvia of poiſonous plants; ſome places alſo remarkable for ſulphurous and mineral exhalations. Thus much may ſuffice for the properties of the air, ſo far as concerns our purpoſe.

The PROPERTIES of the element of WATER ſhall be inquired into next and demonſtrated.

Water is a fluid element, and void of elaſticity, almoſt incapable of being condenſed or expanded in a groſs ſtate, yet capable of ſuch a degree of expanſion when reduced to vapour, as to float in air. It is very penetrating and inſinuates itſelf into many bodies, ſo as to ſeparate their parts, and in this reſpect is an extraordinary menſtruum; yet it unites others and makes maſſes of looſe matter become exceeding hard. It is without taſte, without ſmell, without colour; by extreme cold, loſing its fluidity, and becoming hard under a new denomination of ice.

PRO-

PROPOSITION 6.

Water is a fluid element void of elaſticity, almoſt incapable of being condenſed or expanded in a groſs ſtate, yet capable of ſuch a degree of expanſion in vapours, as to become lighter than air, and to float in it.

DEMONSTRATION.

Rivers and fountains have their banks to confine this element, which otherwiſe would flow indifferently on all ſides; and the ſea muſt have its ſhores, otherwiſe the whole ſurface of the earth would be covered with water. When it is taken in ſmall quantities for human uſes, it muſt be confined in veſſels of ſuch a cloſeneſs, as to materials and workmanſhip, as not to allow it a paſſage, except where the artiſt intends. And when it is confined to a veſſel without any aperture at all, ſuppoſe of metal (as the experiment has been tried with a braſs globe) it is not capable by any force of compreſſion, of being reduced to a narrower ſpace, but will either burſt the veſſel if violently preſt, or paſſing through the cracks *(o)* of it appear upon the ſurface like a dew. If it ſeems to have elaſticity from ſome appearances, as that of ſtones and cannon balls rebounding from it, at a certain degree of inclination; thoſe appearances may in ſome meaſure be attributed to the great quantity of air contained in common water, which a pure element of water would be free from: But this can have only a ſmall effect. Therefore the expanſion of water in a boiling ſtate, which ſome have found to be $\frac{1}{15}$th part of its dimenſions in a cool ſtate, may be attributed to a violent motion, which occaſions what are called fulminating bubbles, as well as to the expanſion of the penetrating air.

This proportion of expanſion *(p)* belongs to water, as preſſed by the common weight of the atmoſphere; but if we ſuppoſe water preſſed with a

(o) Cracks is uſed here inſtead of pores, as being the true manner of expreſſing it. For water can not by any force be made to paſs through pores, through which it would not paſs by mere gravity or attraction. The ſpherical body can not be compreſt without altering its figure, and conſequently not without occaſioning fiſſures, through which the water may paſs, although it could not paſs through the pores. Perhaps there may be a ſmall degree of compreſſion (tho' not capable of being brought under computation) owing to the air contained in it. Perhaps alſo in ſome inſtances to other phyſical cauſes. See the generation of ice, page 36.

(p) Boerhave Chem.

more weighty atmoſphere, or with any other fluids, ſuch as boyling oyl or metals melted, its expanſion when tried in ſmaller quantities, is ſuch, as to produce very terrible effects, and ſcatter the boiling maſs with a great exploſion. Its capacity of riſing in vapours, is owing to its capacity of expanſion in ſmall maſſes, and the expanſion of the air which it always contains, or readily admits by Prop. 1. Lect. 1. This air rarified by heat, reduces the heavy water to vapours, of the form of little blown bladders, lighter than ſo much cool air, and capable of floating in it, which therefore briſkly aſcend into the atmoſphere, and that often with ſuch force as to be the means in fire engines, of raiſing water out of mines and ſubterraneous places, at the depth of ſome hundred feet; whereas by means of the intire preſſure of the atmoſphere, water in common pumps can only be raiſed two or three and thirty feet.

SCHOLIUM.

The caſe of bodies rebounding from water, having impinged obliquely upon its ſurface ſhall be conſidered.

Water is not elaſtic, for not being capable of condenſation it can not be contracted into more narrow bounds, and afterwards expanded to occupy its original ſpace; which is the manner whereby wool, air, and many other elaſtic bodies reſtore motion: Yet water has a property whereby it produces ſimilar effects with elaſticity: A cannon ball rebounds from the ſurface of the ſea, with a force ſufficient to do great miſchief: A flat ſtone thrown obliquely on the water ſhall riſe and fall, and riſe again, with ſeveral alternations, before it loſes motion: The cauſe of this is, the water's quality of yielding to force, and the neighbouring part of the fluid riſing thereby in circular waves, which by gravity immediately endeavouring to ſubſide, muſt ſuddenly ſwell or raiſe the hollowed ſurface, and thereby give a new direction to the moving body, which had ſtruck the fluid ſurface in an oblique direction; which body riſes with a diminution of force, and ſo on, untill the impreſt force being exhauſted, nothing acts but gravity, and the body ſinks, if it be ſpecifically heavier than water. The diminution of force in theſe caſes, is owing principally to the reſiſtance of the air, the motion being horizontal; and partly to the non-elaſticity of the water, to whoſe

ſurface

ſurface the direction of motion being oblique, only part is diminiſhed thereby: But if the direction of motion was perpendicular to the ſurface of the water, and the body fell upon a fluid ſurface exactly equal to itſelf, in a veſſel confining the water to the ſhape of the falling body, in that caſe upon colliſion there would be a total loſs of motion, and conſequently no repercuſſion: For the cloſeneſs of the veſſel to the ſhape of the falling body, would hinder any waves to ariſe laterally: and the water not being elaſtic can not convene cloſer, and ſpring again, to its former dimenſions; as was demonſtrated before.

But although water has not that kind of elaſticity, which wool and other ſimilar kinds of bodies have, which may be compreſt into a narrower ſpace; yet it ſhould be conſidered, whether the property of water, where the upper ſurface is only bounded by the air, does not nearly reſemble the motion of a ſpring of ſteel, which acts elaſtically, not by being compreſt into a narrower ſpace, but by being bent; ſo as to occupy another ſpace neither more nor leſs than the former, and immediately reſtoring itſelf to the poſſeſſion of the original ſpace.

Water by a manner ſomething ſimilar to the motion of a ſpring of ſteel changes the direction of motion, but inſtead of reſtoring motion, diminiſhes it; and is a non-elaſtic body, *(p)* except in as much as it always contains more or leſs air, it muſt partake more or leſs of elaſticity: Hence perhaps in a ſummer ſhower of rain, which ſometimes falls ſuddenly, and in very large drops, one may obſerve upon the ſurface of a pool of water, ſomething that looks like a rebounding of each drop from the ſurface: But it ſhould be remarked, the form of that rebounding matter, is not orbicular as drops of rain are, but like a ſhort column of water erected upon the ſurface, and continuous to it. The ſame columns appear, but ſometimes with an orbicular top; when water falls in drops upon the ſame fluid, contained in a baſin for the experiment; but by increaſing the height of the fall, you will not in proportion increaſe the height of the aſcending column or drop, which ſhould be the caſe, if water was elaſtic. For an elaſtic tennis ball, will rebound perpendicular, in proportion to the force with which it ſtrikes the elaſtic

(p) Gravitas undarum ſupplet locum vis elaſticæ. Newtoni Philoſ. Nat. Prin. Math. Prop. XLIII. lib. II.

floor; that is, in proportion to the height from whlch it falls, if the force of gravity alone be the impeller.

In the falling of water in the form of drops, it is not ſo; for the drops of rain falling in the warmeſt ſummer's day, when the vapours may be ſuppoſed to aſcend higheſt, and being in great abundance, upon collection form larger drops than at any other time: The columns of water after the percuſſion of each drop, is not ſeemingly ſo high as that of an ordinary drop of water, let fall for the ſake of experiment, from the height of three or four feet. From which height you may obſerve a column about one inch and an half, growing taper towards the end, to which there ſeems joined a little ſphere of water, which quickly returning by the force of gravity, excites a low ſound, after that of the firſt drop, as if a ſmall one fell immediately after a large one.

If water drops from an height upon a board or marble, it will ſplit into ſmall portions and flie obliquely; but this is only a change of direction of motion, and a diviſion of the moving body; and ſomething of the ſame effect there will be, when water falls upon water in form of drops: But otherwiſe when it falls in a groſs body, as appears from cataracts, near which a ſpectator may conveniently ſtand without annoyance, except that of a ſort of dew, which the violent colliſion of the water rather againſt rocks or the hard matter, that contains it, occaſions, than any action of itſelf upon itſelf.

PROPOSITION 7.

Water is very penetrating, and inſinuates itſelf into many bodies, ſo as to ſeparate their parts, and in this reſpect is an extraordinary menſtruum, it alſo unites and makes maſſes of looſe matter become hard.

DEMONSTRATION.

The phænomena of diſſolved ſugar, ſalt and gum, by water, are well known, as well as the uniting of flower to make paſte, and lime and ſand to make mortar by water. Dry earth or clay, may firſt be diſſolved by water, and then being dried again, ſhall become a harder body than it was before.

PRO-

PROPOSITION 8.

The element of the water, is without taſte, without ſmell, without colour.

DEMONSTRATION.

All colour in water is univerſally attributed to ſome heterogene matter mixt with it: And the practice of water drinkers *(q)* does ſufficiently inform us, that true water is only that which is without taſte and ſmell; for ſuch they always prefer for Beverage, when it can be had.

PROPOSITION. 9.

All water has a petrifying quality.

See this demonſtrated in Lecture 5. which is placed there, becauſe having a cloſer relation to the principal phænomena under conſideration, it ſhould ſtand in the neareſt point of view.

PROPOSITION. 10.

Water is capable of loſing its fluidity, becoming hard under a new denomination of ice.

DEMONSTRATION.

In theſe northern countries it is needleſs to demonſtrate this, any other way, than by referring to the phænomena of every winter; although in hot climates between the tropics, the aſſerting of it would remove all opinion, of the veracity of the perſon aſſerting it. Inſtead of a formal

(q) Sentiri quidem aquæ ſaporem ullum vitium eſt——odor nullus eſt in aquis; aut ſi ſentitur omnino vitium eſt. Mirum tria Naturæ præcipua elementa ſine ſapore eſſe, ſine odore; Aquas, aera, ignes. Plin. Nat. Hiſt. lib. 15. c. 27.

formal demonſtration of it, ſome properties of ice and the manner of its production ſhall be laid before you.

There will appear a good reaſon for this hereafter, when the generation of the cryſtals of the lake come to be ſpoken of, the ancient opinion having been, that they are ice brought to ſuch a degree of hardneſs, as to become incapable of diſſolution by warmth.

Ice is lighter than water, and therefore ſwims in it.

One certain degree of cold always produces it, and a greater degree of cold, produces harder ice. Yet the ſame degree of warmth, always diſſolves the hardeſt as well as the ſofteſt.

It has been obſerved that ice often begins to thaw in the lower ſurface, which therefore is owing to the influence of central heat conveyed through the pores of the earth.

Ice is elaſtic although water is not ſo, and the harder the ice, the more elaſtic, as is plain from hard bodies rebounding from it after percuſſion; it is in all things like glaſs, except that of not bearing fire in a certain degree, and yet it contains fire in it, in ſome degree.

The manner of the production of ice may be explained thus. All water has air in it, Prop. 1. Lec. 1. And this air being diſperſed through the fluid, in very ſmall ſeparate portions has very little elaſticity; but when the particles of the water, are by cold conſtringed and preſſed cloſer together, the ſmall cells of air are alſo preſſed out of their places, and blended with one another, ſo as to form much larger cells of greater elaſticity: Hence it is that although the preſſing of the matter of the element of water, ſo as to make the matter of it, wherever it is, denſer, and therefore heavier, yet upon account of the large cells of air, which perhaps have alſo received an increaſe from the ambient air, at the beginning of freezing, a quantity of water when turned to ice, is made to occupy a larger ſpace, and is therefore ſpecifically lighter. This manner of production explains the reaſon alſo why ice burſts veſſels, and why ice which is made in vacuo, the water being previouſly purged of air, is ſo heavy as to ſink in water, not being equally expanded for want of an equal quantity of interſtitial air; but all ice made in the open air ſwims in water being in ſpecific gravity to water as 8 to 9. But in as much as air can not be totally exhauſted by any pneumatic engine, out of any

any ſpace; ice may be formed in vacuo according to the philoſophy juſt laid down, yet that ice ſhall differ in weight ſpecifically, from ice formed in the open air.

It is very remarkable, that there is no intermediate degrees between water in its fluid ſtate and ice; that is, water is always equally fluid, and when it ceaſes to be ſo (which one certain degree of cold occaſion) it becomes ice: Boiling water is not more fluid than the coldeſt water, immediately before it becomes ice.

The properties of earth ſhall be next inquired into and demonſtrated.

Earth is that matter upon which we tread, but in as much as it is hardly poſſible to take two ſteps upon exactly the ſame kind of earth *(r)*; it muſt not be defined by any qualities peculiar to any portion of earth, but by thoſe which are common to all portions of it.

Earth is hard, reſiſting touch and fire; it is brittle and does not diſſolve in water, but ſubſides in it, or contains it as a baſin.

PROPOSITION. 11.

Earth is hard, reſiſting touch and fire.

DEMONSTRATION.

The idea of ſoft we are ſenſible of, when we feel water; for its parts eaſily yield to a preſſure, and ſlip away from the preſſing body; but earth yields with more difficulty, and if the preſſure be forcible, occaſions pain or damage: And whereas water goes off in vapours excited by the force of fire; earth keeps its ſtation, and although it may ſeem to ſuffer a change upon account of other elements mixt with it, yet the elemental earth ſuffers none. For earth burnt to a brick, is ſtill earth with a diminution of water which it once had united to it, and an addition of fire.

PROPOSITION 12.

Earth is brittle and does not diſſolve in water, but ſubſides in it, or contains it as a baſin.

This

(r) See note † page 7.

This is generally true of viſible common earth of the globe, and ſtrictly true of the virgin earth, which chemiſts by fire ſeparate from the other elements, of which they make their beſt veſſels for containing matter, on which they try experiments in intenſe fires. But our purpoſe being rather to ſpeak of the elements in the groſs form, that is, in the mixt form in which they are conſtantly to be found, as the functions of nature are exerciſing in the globe; in that ſenſe we ſay alſo that earth is brittle, and does not diſſolve in water, but ſubſides in it, or contains it as a baſin.

The brittleneſs or friability of earth, appears to any one who uſes the hand or hammer, and although after it is crumbled and thrown into water, ſome kinds of it may ſeem to diſſolve and ſwim in the fluid, it afterwards ſubſides; except that part of earth which makes part of the groſs element of water. For by the propoſitions in the former lecture, every element contains in it ſome parts of all the other elements.

That earth makes convenient baſins for water, appears from the view of fountains, lakes, rivers and the ſea; all which are ſupported and bounded by earth; which boundaries were they neceſſarily liable to diſſolution by water upon contact, would mix with it, and that which we now call a globe of earth, would become a globe of clammy fluid.

The properties of fire ſhall be enquired next into and demonſtrated.

Fire is the moſt ſubtile of all the elements, it penetrates all bodies, ſeparating the parts of ſome, and uniting the parts of others; and actually takes place in every body, and exiſts alſo in places almoſt totally vacuous of other matter.

PROPOSITION 13.

Fire is the moſt ſubtle of all the elements and penetrates all bodies.

DEMONSTRATION.

If fire was not the moſt ſubtle of all elements, there might be found ſome bodies too compact to admit it; but none ſuch can be found: The denſeſt bodies admit it moſt plentifully and retain it longeſt, for the proportion of heat which bodies are capable of receiving is in proportion to their denſities. Iron is capable of receiving a greater degree of heat

heat than wood, and marble is more ſuſceptive of it than plaiſter: Of woods the weightier are ſuſceptive of more heat than the lighter: Oak is ſuſceptive of more than fir deal. But ſome allowance is to be made for the tenacity of the parts whereby in ſome inſtances, the lighter body may be made the hotteſt; as oyl which is lighter than water, is ſuſceptive of more heat upon account of the adheſion of the parts which hinders it to go off ſo ſoon in vapour. Molten metals are capable of receiving a much greater degree of heat, except mercury which is an extraordinary metallic fluid, which a ſmall degree of heat diſſipates. Air is ſuſceptive of different degrees of heat, according to its different degrees of denſity; therefore it is hotter in its loweſt parts, near the ſurface of the earth where it is more denſe, and colder in its upper regions where it is rare: Hence it is, that ſnow lies upon mountains, when it thaws in vallies; hence it is alſo, that ſnow, froſt and hail, are generated in the upper regions of the air *(p)*.

Water alſo is ſuſceptive of a greater degree of heat, at one time than another. When the atmoſphere is weighty and preſſes moſt upon water; water is then capable of the greateſt degree of heat, when the atmoſphere is light, water is ſuſceptive of a leſs degree: In any other reſpect the heat of water, cannot be increaſed beyond that which belongs to it in a ſtate of boiling which in the ſame atmoſphere is always the ſame.

The degrees of cold which bodies are ſuſceptive of, is alſo in the ſame proportion. Marble is ſuſceptive of more cold than wood, and metals are ſuſceptive of more cold than marble.

Fire lies concealed in water and ice, tho' ſeemingly contrary to its nature; by colliſion it may not only be ſtruck out of flints, but alſo out of ice, and broken waves in a ſtorm emit a conſiderable quantity of it. The atmoſphere abounds with fire, which the frequent phænomena of meteors and lightning ſufficiently demonſtrate.

(p) There are other circumſtances to be conſidered in producing theſe effects. The vallies are hotter than the tops of the mountains, for other reaſons beſides the greater denſity of the air below; the vallies have both the direct rays of the ſun, and thoſe alſo which are reflected from the ſides of the mountains, but the tops of the mountains have only direct rays. This difference of heat is ſo conſiderable, that on ſome mountains ſnow lies perpetually; and in travelling over the Alps, a man may be in cold, barrenneſs, and ſnow, one part of the day; and in warmth, verdure and fertility another part of the ſame day.

PROPOSITION 14.

Fire ſeparates the parts of ſome bodies, and unites the parts of others.

DEMONSTRATION.

The common culinary experiments of boiling and baking ſhew this; For by one a fluid is agitated into vapours, by the other it is brought to a firmer conſiſtence. Different degrees of fire have different effects, by one degree, plants ſhall burn and partly go off in ſmoke and vapour, and the remainder in the form of aſhes, ſhall be diſperſt by a ſmall wind or waſht into the earth by rain: by a greater degree of fire thoſe aſhes ſhall become a glaſs, incapable of diſperſion by wind, or of diſſolution by water. Hay ſet on fire commonly vaniſhes partly in air, partly becomes aſhes. But a great quantity of it taking fire ſome years paſt, at the barracs of Dublin, the intenſeneſs of the fire vitrified the aſhes. Kelp which is ſo much uſed in the manufacture of hard ſoap, linen, and glaſs, is no more than the ſalts of a plant common upon the ſea ſhores. The plant by fire is firſt reduced to the ſtate of a boiling clammy fluid, by continuance of fire it becomes hard cakes called kelp, this by a mixture with ſand in a more intenſe fire, afterwards becomes glaſs. So then one degree of fire preſerves the plant in the form of a plant; another degree changes that form into that of a clammy fluid, and preſerves it in it; another degree changes that form, into that of hard cakes or rather ſtones, which muſt have a certain degree to preſerve them in that form; another degree changes that form into that of glaſs, which alſo muſt have a certain degree to preſerve it in that form. For ſince by the former propoſition, fire is in all bodies, and it muſt be in all ſtates and forms of any body; by this inſtance it appears plainly to be a principle of union and diſunion, according to different degrees of it.

Other plain inſtances of theſe properties may be given.

One degree of fire keeps water fluid, a leſs degree ſuffers it to become ice, and a greater degree than the former diſperſes it in vapour.

Lightning which is an extreme ſubtle fire, has prodigious effects in the diſſolution of bodies. It can inſtantaneouſly melt the bones of a human

man body, and not deform the fleſh, it can melt a ſword and not damage the ſcabbard. An extraordinary inſtance happened in this kingdom, in the year 1707 *(q)*, and a later inſtance in the county of Tir-Owen, in 1749. A ball of fire deſcended into the kitchen of a gentleman's houſe by the chimney, and rolling on the floor divided into two parts: One part being ſelf extinguiſht became water, the other darted through the cieling, where ſome of the family were ſitting, and the ladies at work, particularly a mother and a daughter, both holding ſciſſars, juſt in the act of delivery of them from one to another; the daughter was killed, and part of the ſciſſars melted; the reſt of the company eſcaped.

The other ſtory being related in the philoſophic tranſactions, I refer you to it; only remarking that the lightning penetrated through the roof of the houſe, the floor, and three hundred and fifty folds of linen, making a hole of a ſquare form, broke, killed, and ſcattered many things.

PROPOSITION 15.

Fire not only takes place in every body, but exiſts alſo in places almoſt totally vacuous of other matter.

DEMONSTRATION.

Two ſticks rubbed on each other with a ſtrong preſſure for ſome time, may be made to take fire and blaze, which often happens in the axle trees and naves of carriages. Iron by friction may be made red hot: A cannon bullet receives a conſiderable degree of heat, when it paſſes through the air; and gunpowder has been fired at the bottom of the ſea, in a machine contrived for the purpoſe, into which neither water nor the external air could penetrate. And the INQUIRER remembers particularly, when ſome iron guns were landed ſome years paſt on the cuſtom houſe wharf, in Dublin, which had been part of a wreck of one of the Spaniſh ARMADA, taken up by Divers lately upon the coaſt of Scotland; that the metal was corroded much by ruſt, but changed ſo as to be capable of being reduced to a black powder, like black lead crumbled,

(q) A place called New Forge, on the river Lagan. See Phil. Tranſ.

and that, merely by ſtriking it with a key; a ſmall quantity of this he carried home in a paper graſped in his hand, which grew ſo hot during the walking the length of three ſtreets, as almoſt to become intolerable.

The vacuum which is made in the top of a Barometer by well depurated quickſilver is more free from matter, than perhaps any that can be made by ſuction in the air pump. For air being an exceeding elaſtic body, is almoſt in the ſmalleſt portions of it capable of ſuch expanſion, that although by every ſuction ſome air is diſcharged, what remains expands itſelf and becomes thinner, and cannot be totally exhauſted: But the Barometer or tube of glaſs being filled with well cleanſed mercury may be inverted, to let the mercury ſubſide; there is then as vacuous a ſpace left above, as human art can make: Yet by the agitation of this mercury, the end which was open being ſtopped, and the tube being often turned, ſo as to make the mercury move from end to end, a light may be excited in the vacuous part of the tube.

It is probable that fire is extended all over ſpace; although it is diſcernible by its effects only in ſome parts. When the rays of the ſun are collected by a mirror or burning glaſs, and thrown into a focus, the heat of that point is prodigious, which ſuddenly melts or conſumes bodies; yet if paper be held between the glaſs and the ſun, that fire inſtantly vaniſhes; but whither? Not out of nature, for the rays of the ſun are real matter, and can not be annihilated without a miracle: They are therefore ſtill exiſting, tho' all ſenſible effect has ceaſed. Hence we ſhould infer, that it is equally poſſible for fire to exiſt unperceived by us in any other points of ſpace.

The late experiments of electricity, ſeem to prove an univerſal fiery æther? and although the exertion of the influence of this æther upon groſs matter are not at all, or very imperfectly known, yet the extent of its influence being unlimited, proves the æthereal fire itſelf to be ſo *(r)*. Perhaps future diligence and nicety of obſervation, may bring many ſecrets to light, of this kind, and open ſome pages more of the volume of nature, to thoſe who are diſpoſed to read it. For this ſtudy can never be exhauſted; to him who has travelled fartheſt in it, there ſtill

(r) Concerning the Analogical application of this to Theology. See the Analogy of Divine Wiſdom, in the Material, Senſitive, Moral, Civil, and Spiritual ſyſtem of things, publiſhed laſt year, by the Author of this book.

ſtill appear large fields quite uncultivated, too much for human abilities, or human life, tho' it was protracted to any antediluvian length. But ſo is every thing about which human nature is concerned, or indeed ought to be concerned. Human appetites of all kinds are unlimited, when unreſtrained by reaſon: whether they regard knowledge, or riches, or power, or life. Yet a purſuit of theſe things (never to be obtained ſo as to ſatisfy the greedineſs of deſire) is praiſe worthy, and the duty of every man, ſo far as to give the human mind employment, and to keep human nature active.

To the properties peculiar to the elements demonſtrated in this lecture ſhall be annext two properties of matter in general.

PROPOSITION 16.

All matter is in abſolute motion.

This globe of earth in turning upon its axis, moves every part of its matter with great rapidity, and thoſe upon its ſurface are moved at the rate of one thouſand miles an hour, or more than fifteen miles a minute; but as it moves round the ſun in an elliptical orbit, differing very little from that of a circle, whoſe diameter is one hundred and ſixty millions of miles, it muſt move at a more rapid rate, than that of one million of miles a day. And ſeeing that every planet moves round the ſun, in a leſs or a greater orbit, and in a leſs or greater time, and conſequently with a leſs or greater motion; and every ſun revolves upon its own axis, every particle of matter muſt be in real abſolute motion. Notwithſtanding this the relative ſituation of many bodies, continuing for many ages the ſame, may haſtily incline ſome perſons to think that abundance of the matter, at leaſt of this our globe, is at reſt; but a demonſtration of what has been juſt aſſerted, for which we refer to aſtronomy, is a demonſtration of this univerſal circumſtance of matter: By this is not meant, that motion is of the nature of matter, or inſeparable from it: For matter is indifferent to motion or reſt; and as it can not move itſelf, ſo neither can it ſtop itſelf, being by nature inert, that is, incapable of action, which muſt always ariſe from intelligence. We

mean

mean in this propoſition only, to demonſtrate one circumſtance of the ſtate of things, to wit, that all matter is in real abſolute motion.

But the propoſition principally means the matter of this globe. Now this globe has not only a rotation upon its axis, and a rapid annual motion in its orbit as deſcribed, but all the parts of it within themſelves, have an infinite variety of inteſtine motions: Like a ſhip under ſail, impelled by the wind at the rate of three or four leagues an hour, whilſt within an inconceivable number of motions may be performed; ſome conſpiring with the motion of the ſhip, ſome ſeemingly directly contrary to it, others in various degrees of obliquity. Moſt of the matter of this globe, perhaps all, has an inteſtine motion, whereby ſome particular private phænomena are produced or preſerved, beſides the general motions belonging to each maſs. The air is in a perpetual oſcillatory motion, being ſubject to momentary changes of influence from the ſun; fire or æther ſeems to have ſo much motion as to be the inſtrument of motion to every thing material: Water, whether in the form of ſprings, vapour, rain, rivers, lakes or ſeas, is ever moving; and even when in a ſedentary ſtate, according to the vulgar manner of expreſſing things, it has the motion of corruption, and as it were, quickens with animal life, and thereby acquires a new kind of loco-motive power within itſelf. And as a great partof the matter of this globe, belongs either to animals or vegetables, all ſuch matter muſt be in motion, for growth implies the motion of blood or ſap. The great Mr. Boyle has obſerved with extraordinary nicety, that the ſpots in precious ſtones have changed their places, and performed as it were periodical revolutions, and the natural ſtains of marble have been obſerved by many to have changed. For earth can not be a ſluggiſh motionleſs element, when the other elements with which it muſt hold perpetual commerce, are employed in functions, which require motion. All matter therefore is in abſolute motion (s) Q. E. D. PRO-

(s) Notwithſtanding this, the propriety of ſpeaking of ſome particles of matter, as being at reſt muſt be allowed: For if men in a ſhip which is under ſail, ſitting round a table may be ſaid to be at reſt, in reſpect to the offices of working the veſſel, although they move with the ſhip, and the blood and all the parts of their bodies move within themſelves, ſo in many reſpects we may ſpeak properly of matter, as being at reſt. Sir Iſaac Newton is obliged to uſe the terms *the force of bodies*, although he informs the reader that bodies have not force, being only capable of receiving impreſſions, and yielding to force which intelligent movers give.

PROPOSITION 17.

All matter is extremely porous, that is, every maſs of matter contains within its ſurface, more ſpace that is void of matter, than that is filled with it.

DEMONSTRATION.

The gravity of all matter being ſuppoſed as a property not needing proof at this time; it is plain, that the weight of all bodies muſt be in proportion to the quantity of matter contained in equal ſpaces; and the more matter in any ſpace, the greater is the weight of that maſs: And ſo in the converſe, the greater the weight of any body, compared with another of the ſame dimenſions, the greater quantity of matter it contains: ſo then all lightneſs is no other than vacuous ſpace, within the ſurface of matter, and weight is no more than matter occupying ſpace in a more or leſs compact congeries. Now gold of all kinds of matter being the heavieſt in ſpecie, muſt alſo contain more matter within the ſame limits of ſpace compared with other bodies. Yet gold *(t)* is found

(t) ‘ Sir Iſaac Newton ſhews, that bodies are much more rare and porous, than is commonly believed: Water, e. gr. is nineteen times lighter, and conſequently rarer than gold; and gold itſelf is ſo rare, as very readily and without the leaſt oppoſition, to tranſmit magnetic effluvia, and eaſily to admit quickſilver into its pores, and to let water paſs through it. For a concave ſphere of gold hath, when filled with water, and ſoldered up, upon preſſing with a great force, let the water ſqueeze through it, and ſtand all over its outſide, in multitudes of ſmall drops like dew, without burſting or cracking the gold: Whence it may be concluded, that gold has more pores than ſolid parts; and by conſequence that water hath above forty times more pores than parts. Dictionary by Chambers, in the word PORE.

If water can not be made to paſs any where by artificial force, when gravity or attraction alone would not be ſufficient for the purpoſe, the foregoing experiment is liable to exception, and it may be ſaid that the water paſſed through cracks or fiſſures of the metal. But not to dwell upon theſe circumſtances, let the truth of what is aſſerted in the propoſition be determined, by the ingenious John Keil, Lect. 5. Theor. 2.

‘ That all bodies are very porous, that is, contain but a very ſmall quantity of matter, in reſpect to their bulk, is moſt certain from the properties of diaphanous bodies; for the rays of the light within glaſs or water, are infuſed in right lines as well as in air, whatever

‘ ſide

found by naturaliſts to have abundantly more vacuous ſpace in it, than ſolid matter; and conſequently all other kinds of matter, ſpecifically lighter, have a fortiori more vacuous ſpace than gold; but vacuity of ſpace is what we call pore. Therefore matter of all kinds is extremely porous. Q. E. D.

‘ ſide of the diaphanous body is expoſed to the light: And therefore from any the leaſt
‘ aſſignable part of the diaphanous body, to any other part of it, there is always extended
‘ in theſe bodies, a rectilinear pore; through which the light may paſs; and this can not
‘ be, unleſs the matter of the diaphanous body obtains but a very little proportion to its
‘ bulk; and perhaps the quantity of matter in glaſs, has not a greater proportion to its mag-
‘ nitude than a grain of ſand, to the whole bulk of the globe of the earth: But that this is
‘ not impoſſible, we have ſhewn above. Whence ſince gold is not eight times denſer than
‘ glaſs, its matter alſo to its proper bulk, bears but a very ſmall proportion.

LECTURE
OF
METAMORPHOSES,
Or a CATALOGUE of
SPECIMENS
OF THE
Tranſmutation of one ſort of matter into another.

Res obſcura quidem eſt ——————
Mira tamen: vidi præſens ſtagnumque lacumque
Prodigio notum. Ovid Met. lib. 4.
Dic age (nam cunctis eadem eſt audire voluptas)
Quis fuerit Cœneus, cur in contraria verſus? lib. 12.

Alſo a CATALOGUE of

GEMS and CRYSTALS found on the Shore,
AND IN THE
Neighbourhood of *LOUGH NEAGH.*

LECTURE III.

Sedebat
In ſolio Phœbus claris lucente ſmaragdis. Ovid Met.

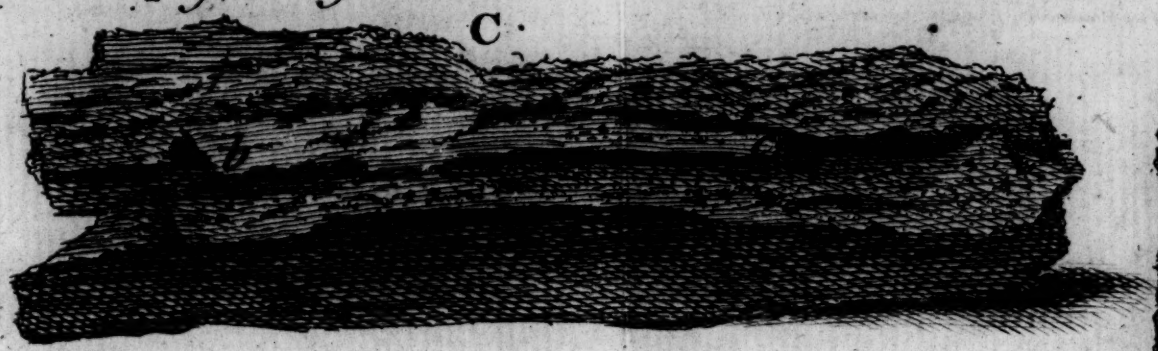
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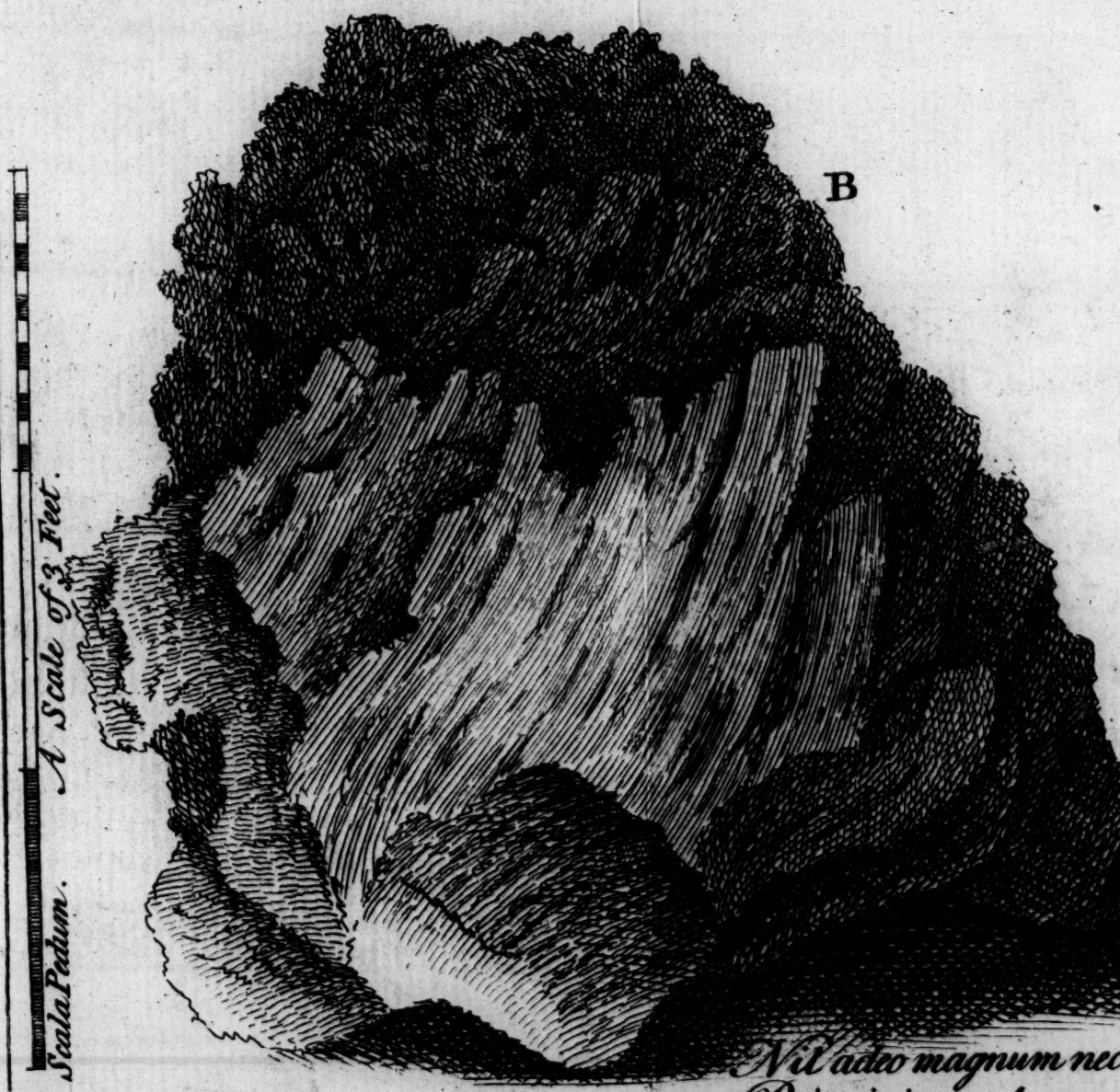
CONFIDENCE in a writer is always diſagreeable to a reader: Becauſe readers may have as good an opinion of their judgments as the writer has of his, and would rather ſeem to teach themſelves, than be taught by any one. The Inquirer therefore is quite averſe from giving any opinion in his book with a confident aſſurance of its truth; he only deſires to ſhew upon what principles of reaſoning he founds his judgment, which he has in great meaſure done in the foregoing Lectures, and if the ſame degree of evidence appears to others, when theſe principles come to be applied to the phænomena treated in the following Lecture, the conſequence will be the ſame opinion. But whether his reaſoning be upon true principles or not, or whether the application of them to the phænomena be juſt or not, the phænomena themſelves, of which the catalogue follows, as neceſſary to be peruſed before reaſoning can be founded upon them, is a valuable diſcovery; and the credit of this, it is hoped, the reader will not refuſe him. Honeſty is what ſhould always belong to human nature, becauſe every man can give this to himſelf: Ingenuity is a divine gift, and is not the talent of many. As a natural hiſtorian therefore, he hopes, to have credit with thoſe, whoſe diſtance from hence will not allow an ocular view of the ſpecimens. For the annext catalogue is intended for the uſe of foreigners; by foreigners are to be underſtood, all thoſe, who are out of the reach of an ocular inſpection, whereſoever they ſhall be depoſited: And that, it is hoped, will be in the Chartered Society of ſome ſtate in Europe, who will give a reaſonable price for them. At preſent they are depoſited in the muſæum of the Rev. Dr. Richard Pococke, Archdeacon of Dublin, and fellow of the royal Society; whoſe

collection, relating to many branches of knowledge, from Syria, Egypt, and the Archipelago, whither he travelled; as well as in the iſland where he lives, would give ſome honour to our country, if the world was made acquainted with it. The Inquirer wiſhes, that this gentleman would purſue his laudable deſign, and that others being hereby apprized of it may contribute to it. As many ſpecimens as could be ſpared, without incroaching upon the foundation of this book, are given to inlarge that worthy gentleman's collection.

There are above one hundred ſpecimens more, which are extremely well worth viewing, yet are omitted in the printed deſcriptions; leſt the reader ſhould think himſelf too long detained, from the principal matter of this book, to which this, and the preceding lectures are only preparatory; and therefore only ſome deſcriptions taken here and there from the different claſſes, as moſt neceſſary to the main deſign, are exhibited to the peruſal of the reader. In as much as the place has been already mentioned, where the whole collection is depoſited, till ſome eminent purchaſer ſhall lodge them in ſome neceſſary repoſitory of more permanence, than private property can be ſuppoſed to be, the curious may have recourſe to them for ocular, and more general proofs of what has, and ſhall be ſaid of them.

Plate 3. P. 46. fronting Lect. 3.

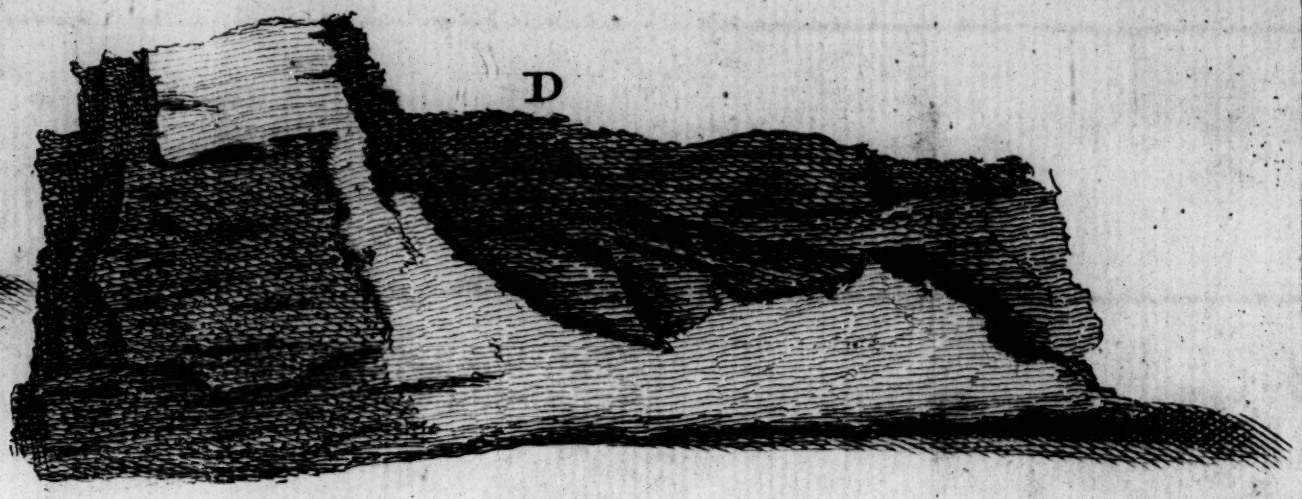


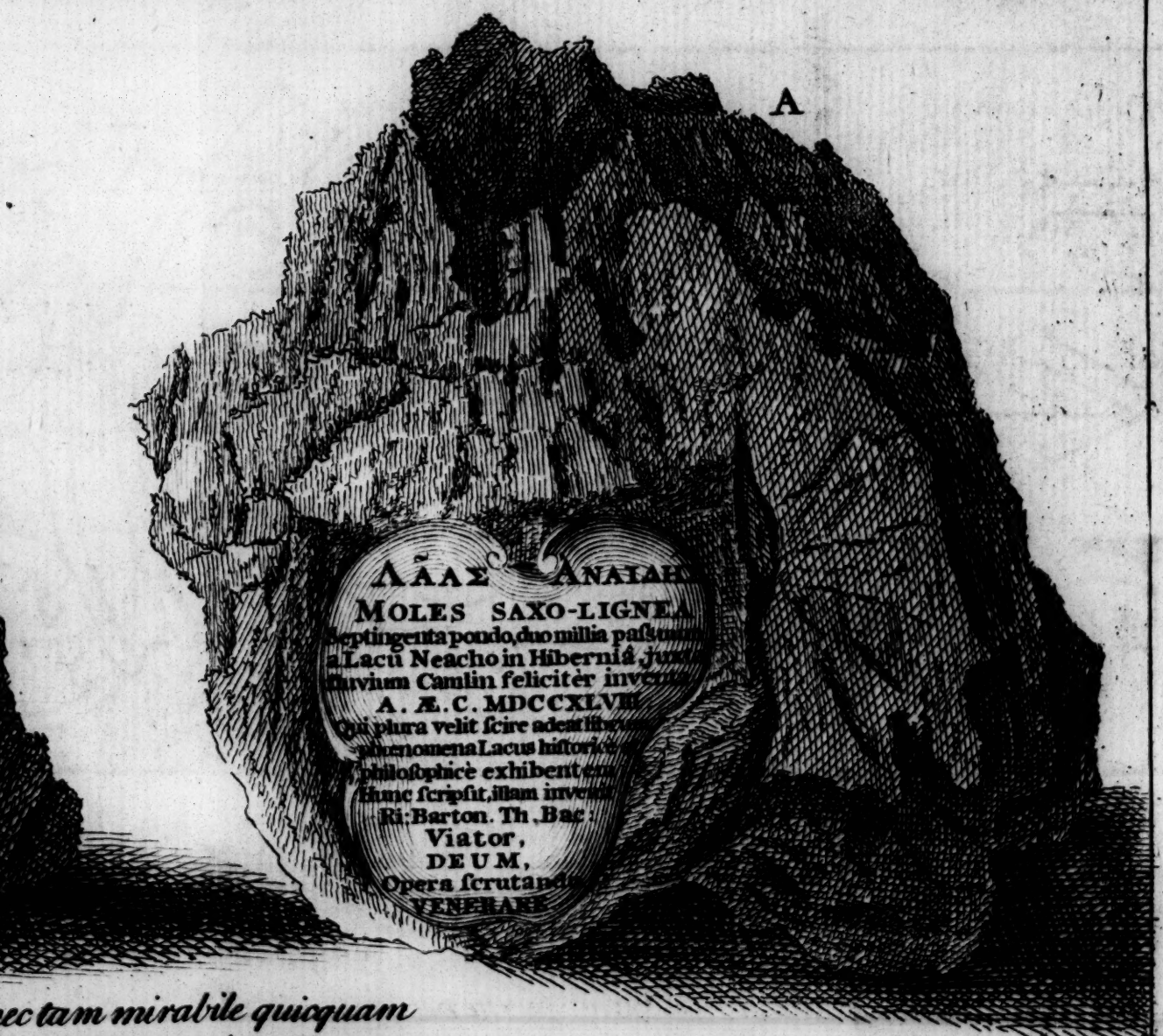


Nil adeo magnum nec tam mi
Principio, quod non minuan
Paulatim.

C. Smith del:

Tabula 3.





nec tam mirabile quicquam
minuant mirarier omnes
Lucretius

T. Chambars sculp.

LECTURE III.

ΛΑΑΣ ἀναιδὴς MOLES SAXO-LIGNEA, plate 3. page 46.

THIS wonderful ſaxo-ligneous maſs, is extremely hard on the outſide, emitting fire upon colliſion with ſteel in great plenty: Yet has it wood, which is very ſoft, internally. C, D are two ſurfaces of a fragment of it, broken with a good deal of labour, from the part where there is now a cavity in *a* *; this fragment has wood in it, in the line *bc*: and is a ſtrong preſumptive evidence, that more wood lies concealed within the ſtone. A good deal was picked out of that cavity by the curious, who firſt ſaw this ſpecimen. The weight of the ſtone, before the ſmall fragment was ſeparated from it, was ſeven hundred pounds, being weighed at the public crane of a market town.

The colour of this ſtone in the ſurface is white ſtained with yellow, this being owing to a bed of yellow gravel, in which it was found, and part of which is to be ſeen preſſed into the little crevices. For the true external colour is white, like that of a firm kind of chalk; but the matter which affords this colour is very thin, not exceeding that of an Engliſh ſilver penny, and capable of being altered by rain; for when it is wet, the ſtone in ſome parts appears of a blue colour. The internal part of the ſtone is a dark grey, that is, any part which is expoſed to view, by the breaking, which likewiſe would appear blue, was it brought to as ſmooth a poliſh, as ſome parts of the external ſurface. It was found two miles from the lake, on the ſide of the river Camlin *(v)*, above the ſurface of the water, which at that time was very low,

(v) See the frontiſpiece of this book.

* A and B are two faces of the ſame maſs.

low, about three feet, it being a perpendicular bank of gravel, with a ſmall mixture of yellow clay, and under another perpendicular bank of the ſame kind of gravel, about ſix feet high. The perpendicular parts of theſe banks, were barren gravel as if newly broken, yet above was good grazing ground, and below was a skin of graſs incompaſſing the ſtone, which lay almoſt totally immerſed in the bed, in the poſture in which the ſtumps of anciently decayed trees commonly appear. Although it has the evident appearance of a ſtump of a large tree, including part which ſhould be under ground, yet is there no appearance of roots extending from it, nor did the bed afford any evident indication, of there ever having been any more of the tree, to which it belonged, in that place. Therefore this was not its native bed; for otherwiſe there would have been at leaſt, ſome veſtigia of the roots either in the form of wood, ſound or rotten, or of wood metamorphoſed into ſtone, as this maſs for the moſt part is. Its white ſurface is an indication of its having been long expoſed to the ſun or open air; becauſe all the ſpecimens hereafter deſcribed as found above ground, are of that colour, and thoſe found under ground, are black. It may be proper to inquire how this maſs was brought hither. It is well known that rivers ſubject to floods, or more properly montaneous torrents frequently roll large maſſes of matter along with them: if it be clay torn from its ſtratum, it breaks it by frequency of colliſion in its motion, and dropping here and there the weightieſt of its conſtituent parts, forms bottoms of gravel in the channels of rivers, but the lighter parts being longer born up are carried further, and make ſhores of ſand to lakes, and to harbours of the ſea: Where the water ſpreading themſelves, loſe their force, and the ſand ſubſides and forms BARS, always more or leſs incommodious for ſhipping. The earthy parts being capable of more comminution than ſand, are alſo capable of longer ſuſpenſion †; and either ſubſide later, and are perhaps ſoon diſturbed again, or are carried into the ſea, and by a diffuſion with that immenſe maſs of water make part of its nature; are born up into the air in vapour, and reſtored again to the earth, in rains, dews &c.——For all theſe have earth in them. But large maſſes of matter, ſuch as this ſpecimen, not capable of eaſy comminution, are, when violently torn from a native bed, ſoon interrupted by obſtacles, ſuch as rocks, trees &c. and being rolled on

† See propoſitions demonſtrated in the firſt lecture.

on the uneven bottom, upon account of the weight; many angular parts and prominences ſuch as roots, muſt be broken off.

The native bed therefore of this ſaxo-ligneous maſs, is not far from the place where it was found, and ſearch might be made for it very near, if the proximity of a fall in the river, which is marked in the map (*x*), and repreſented in the frontiſpiece of this book, did not ſhew the poſſibility of its being eaſily rolled down that ſpace, which being a gradual declivity of conſiderable length, aided the force of the flood.

A Clergyman, ſince dead, whoſe ſtation being in this neigbourhood, gave him frequent opportunities of wading in this river, for he was fond of fiſhing, informed the Inquirer, that he often ſtood upon an extraordinary maſs of matter, in a particular part of that river, which he uſed often to admire, but being more of the rural ſportſman, than the philoſopher, he did not examine into it. Being removed thence forty miles, when he related this, he promiſed to ſhew the place, whenever he went into that country: Death preventing this, deprives the Inquirer of the ability of information in that particular, for his own ſearches did not ſucceed.

Let it ſuffice to ſay, that ſearch muſt be made, according to the courſe of the river, at greater diſtances from the lake, and that the lake never had any inſtrumentality in the production of this rare phænomenon: Becauſe its water at the higheſt never reached this place where this ſpecimen was found.

A latin inſcription is cut on this ſtone with two deſigns, as well to perpetuate the knowledge of the diſcovery, with regard to time, place and other circumſtances, as to diſcover the true qualities of the matter. The workman informed him, that he never cut a ſtone which was ſo injurious to tools before: For although he had cut ſtones that were harder, yet none of them took off the edge of ſteel ſo ſoon; and almoſt at every ſtroke he could ſhew to the naked eye, the gliſtening particles of ſteel upon the ſtone, as well as the injury done to the inſtrument: This was in the rough work neceſſary to prepare the ſhield for the inſcription; in half an hours time he ſpoiled ten tools, which were rendered uſeleſs

(*x*) See Plate prefixt to the following Lecture. Numb. 1. at i; alſo the Frontiſpiece.

leſs without ſharpening, and was forced to get another ſet. When the letters were cutting, he obſerved little lines of cryſtalline matter, ſcarce perceivable to the naked eye, which were ſo extremely hard, as to occaſion gaps in the ſteel: And in many places, he ſaid, he found it very brittle, in reducing the part deſigned for an inſcription into the form of a ſhield; for it often ſplit into little chips like wood. This was not an artifice to inhance the price of the work, becauſe an agreement was made before hand for the execution.

C and D are two repreſentations of the fragment, broken from the top of the large maſs, at *a*. And becauſe this fragment has wood in it in the line *bc*, the large maſs in all probability, contains internally a good deal of it: For there may now in the ſame place be picked out with the point of a knife ſome wood, although in two years time ſince the finding the ſpecimen, this has been often done to ſatisfy the curious.

Number II. INGENS LIGNO-SAXEA MOLES. plate 4.

——— miſta duorum
Corpora junguntur, ———
——Neutrumque et utrumque videntur.

This maſs of wood and ſtone continuous is as much as two able men can lift in a frame, whoſe joints are ſtrengthned with iron. For being carried above ſixty miles by land from the lake to the capital of the kingdom, and being the reverſe of the former ſtone; wood on the outſide, and ſtone within (intra quoque viſcera ſaxum eſt) it was neceſſary to frame it, that it might be fixed in ſo ſteady a manner, as not to loſe by friction the tender part of its ſubſtance, which lay on the outſide: Yet ſome did fall off, and the haſty curioſity of many gentlemen, laying hold of the ligneous part uncautiouſly, occaſioned much more to fall off; in ſo much, that whereas the wood lay on every part of this large ſpecimen, at leaſt one foot thick, except at the ends, where it was broken in the raiſing from a ſimilar maſs, to which it was continuous; it is now only two inches thick in any part, and perhaps in a little time may be much leſs, as the curioſity of many perſons remains to be ſatisfied, who

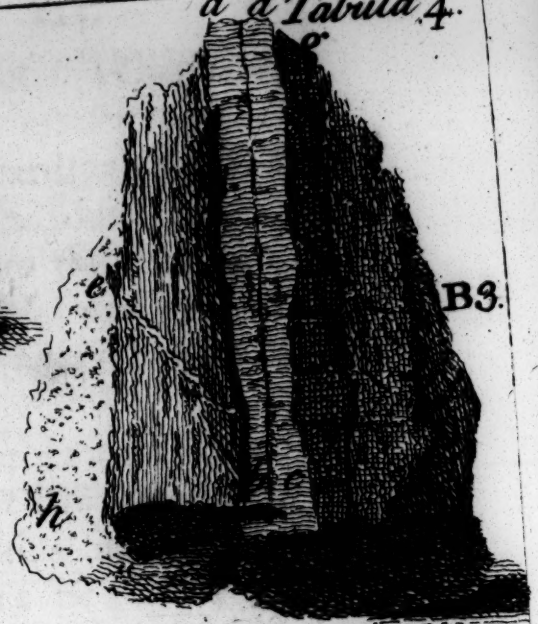
G.B.&I.M.
BR. MUS

Plate 4. fronting P. 55.

Tabula 4.

Manubrium bacilli lignei Lapide Testisque vestitum.





CRYSTALLO-LAPI-LIGNEA MASSA. B1, B2, B3. Sunt enim ejusdem diversè conspectæ diversa imitamina. In triplici Materiâ dubium est quænam totius nomen sortietur.





B1.



MOLES LIGNO-SAXEA diversâ pingitur facie, A1, A2. Eam duo bajuli vix sufferre poterant. Lapidis materia interior est, Ligni exterior. Cum primùm est inventa, Lignum duodecim digitos crassum amplexum est Saxum durissimum. Imprasentiarum itinere 70 Mill. pass. et manibus spectatorum minus caute tractantium fracta crassitiem unius vel duorum digitorum in a non excedit. Sub terrâ est inventa, pars solum modo ingentis MOLIS, totius forsan Arboris, a qua non sine ictibus ferri disjuncta est.

A2.



A1

P. Chambars Sculp.

who are deſirous to have ocular proof of theſe phænomena; and will not be ſatisfied with merely ſeeing, but will handle and break it.

A 1. A 2. are two faces of the ſame maſs, *a d* is wood adhering to ſtone, and of a dark brown colour, *c* is alſo wood; all the reſt of the maſs is very firm ſtone, *b* and *e* being the irregular end of different colours, which difference is not ſo much the nature of the ſtone, as the accretion of dirt in the carriage: from *b* to *f*, where wood lay very thick, when the ſpecimen was found, there are only thin filaments here and there adhering. The ſurface of A 2. is for the moſt part wood, *g* is the appearance of the ſtony part in the lower end.

Number III. INGENS LIGNO-SAXEA MOLES.

This ſtone is as much as a ſtrong man can carry, and is ſo like the former, as to need no further deſcription; being claſſed here merely upon account of the place where it was found, about ten miles diſtance from the former, and in a river about two miles from the lake. The river is that in the maps which paſſing through the town of Antrim, there enters the lake. When this ſpecimen was found, the quantity of its wood, exceeded that of the ſtone.

Number IV, V. DUÆ INGENTES LIGNO-SAXEÆ MOLES.

Theſe two ſpecimens are claſſed together, becauſe they were one ſolid maſs, deſignedly ſplit with a ſledge, in order to diſcover the inward texture, which is a mixture of very hard ſtone and wood, together with ſome of a brittle nature, ſome more firm, and more approaching to the nature of ſtone: The external ſurfaces differ very little from the external appearance of the two former ſpecimens; the ſtony parts of theſe four laſt ſpecimens, are black. It ſhould be remarked that this ſolid maſs, bore above forty ſtrokes of a ſledge of 16lb. weight before it was ſplit.

Number VI.

A fragment of a very large maſs, being as much as one horſe could draw, moſt of it wood, which breaking in the carriage, no more of it is reſerved for this collection, than about 50lb. which being heavier than weighty wood of the ſame ſize, denotes that there is ſtony matter within, of which there is one part plainly diſcerned, being continued to the ſurface, appearing very hard and ſonorous upon the ſtroke of a hammer.

Number VII.

This ſtone is near twenty inches long, and five broad; one ſide is ground to a flat ſurface, is a firm black ſtone, and gives a knife a good edge; the other ſide is wood, and may be cut with that knife in ſeveral places, without ſpoiling the edge. N. B. There was a great quantity of wood, which was broke off in the grinding.

Number XX. LAPIS HOMOGENEUS.

This ſtone is a fragment of a much larger ſtone, altogether of one kind, hard and emitting fire plentifully even upon the friction of another ſtone; ſometimes water has been poured upon it, and in drawing another ſtone of the ſame kind upon the ſurface with a quick motion, almoſt a line of fire has been made, the ſparks came forth in ſuch plenty. It is ground to four ſurfaces, which are good for whetting knives, but not equally excellent. Although it be altogether ſtone, yet has it ſtill the viſible appearance of wood. The bending of the fibres often ſeen in the grain of timber, being very diſcernible in it, as well as the rings of annual growth in the end. It is a mixture of the black and white kind of ſtone, the white being worn away in ſeveral places, by grinding the ſurface. It weighs about 12lb.

Number XXI. A.

Another of the whetſtone kind about five pound weight, having only one ſurface ground for that purpoſe: The circumſtance moſt remarkable in this ſpecimen is, that there appears one large ſtraight fiſſure, running

running the whole length, which is ſix inches, and the breadth, which is four, filled up with a lapideſcent matter, which like glue ſeems to cement two ſtones, rather than to carry on the continuity of the parts of one: And at each end there appears, beſides this fiſſure which extends the whole length and breadth, other irregular fiſſures, three at one end, two at the other, filled up in the ſame manner; as if a piece of wood was by ſome violent force ſqueezed, ſo as to cleave in ſeveral places, and was by an influx of lapideſcent matter, not only converted into ſtone, but had all the cavities filled with it. When clean grained timber is violently ſqueezed at the ends, or ſides, eſpecially when lying in heaps in the natural form of a tree which is round, it is very capable of cleaving: For there are interſtices, into which the unpreſt parts may recede, till the whole maſs becomes cloſe.

Number XXI. B.

This ſpecimen is ground into a whetſtone form, and has not only the white light gritty ſtone externally, and the black ſtone internally; but ſeveral ſtreaks of iron ore, paſſing quite through it lengthways: On one ſurface are two of theſe, which are the moſt conſpicuous, one is ſtraight, the other a little curve: On the oppoſite ſurface, they both are curve. This heterogene matter was collected here upon cleaving the wood as above deſcribed.

Number XXII. XXIII. LAPIDES HOMOGENEI.

Two whetſtones of the white kind; poſſibly within there may be ſome part black, but, although they be pretty deeply ground, nothing black appears except a little ſtreak in one of them.

Number XXIV, XXV.

Two fragments of one long whetſtone of the white kind, which was two feet long, two inches broad, and half an inch thick, being broken into ſeveral pieces in the carriage: The internal texture is expoſed to view, which is white like the ſurface, with a ſmall ſtreak of the black ſtone in each: Some parts rubbed in the carriage whiten the hand like chalk.

Number XXVI.

This is a whetſtone, which as Mr. Anthony Shane apothecary, who was born very near the lake, and is now alive, relates, he made by putting a piece of holly in the water of the lake near his father's houſe, and fixing it, ſo as to withſtand the motion of the water, and marking the place ſo as to diſtinguiſh it, he went to Scotland to purſue his ſtudies, and ſeven years after, took up a ſtone inſtead of holly, the metamorphoſis having been made in that time. This account he gave under his hand writing. The ſhore thereabouts is altogether looſe ſand, and two rivers diſcharge themſelves into the lake very near that place.

Number XXVII.

This is not ground into a whetſtone, not being of a proper ſhape; but it is claſſed here, upon account of the evident tearing of the ligneous fibres tranſverſly, and very irregularly, before the metamorphoſis into ſtone, which it now is become almoſt intirely. For when timber falls promiſcuouſly in a heap, ſome pieces will lie parallel, and ſome tranſverſe, and ſome almoſt upright, and in all manner of directions.

Number XXVIII. A. B.

Two fragments of one maſs, in which the cryſtalline matter appears in different forms. In A, in many ſmall fiſſures, according to the fibrous directions of the wood now become ſtone, but in one part, where they are broken tranſverſly, it appears intermixt with black, ſo as to exhibit a grey colour. N. B. This cryſtalline appearance is never obſerved diſperſed through the woody part of the maſſes, although a ſmall ſlice of wood has been obſerved incompaſſed with a cluſter of cryſtals, lying upon the inner ſurface of a cleft of a large maſs *(a)*.

Number

(a) This leads to a proof, that the matter of theſe ſtones is for the moſt part cryſtal.

Number XL.

This is a ſpecimen of wood alone, which tho' found in the bed of mixt matter, hereafter deſcribed in the hiſtorical lecture, has undergone no change in reſpect to petrification. It is what workmen call burry, or croſs grained, yet it admits a plain, and is thereby reduced to a ſmoothneſs; there is another maſs of ſimilar matter in the ſame claſs, being altogether wood, and cleaves eaſily according to a ſtraight grain; both theſe cauſe a pleaſant ſmell in burning.

Number LI.

Shews the cryſtalline matter, concreted with a maſs of ſmall cryſtals, at the inſide of a maſs of mixt matter, wood and ſtone. *(b)* A is the external ſurface, being firm ſtone, B is part of the interior maſs, being almoſt an equal mixture of wood and ſtone, of a dark brown colour, inclining to black, like many others of the ſame kind; the part C is entirely a cluſter of ſmall tranſparent coloured cryſtals.

Number LII.

This is a curious congeries of mixt matter, extremely rough and irregular in the ſurface, having the white colour peculiar to ſtones long expoſed on the ſhore, but very much dirtied by a kind of froth, obſervable in ſome, like barm in colour, which is dried upon the greateſt part of the ſurface. The maſs being broken, expoſes to view the part A an extreme hard black ſtone, with a few ſtreaks of cryſtalline matter; as well as ſome gliſtening matter equally ſcattered through the black: In the neighbourhood of it, is a cavity very irregular, being lined with a rough concretion of matter, partly ſand and partly cryſtalline matter, in tubercles, wherein the cryſtalline matter gliſtens; in the midſt running the length of the cavity, is a thin prominent ſlice of mixt matter, the external part of which is ſand concreted into ſmall tubercles, and the internal part is

(b) A and B are written on paper and paſted on the ſpecimen, as well as other letters uſed in theſe deſcriptions.

is a line of ſhining cryſtalline matter half way the length, which dividing, exhibits to view, two oppoſite rows of very ſmall cryſtals: So that where a crack in the original wood was very ſmall, the cryſtalline matter appears like a white line; where it is larger, it has ſpace to form cryſtals of a regular figure; as appears more evidently at B. At C in the cryſtalline matter may be ſeen paſſing tranſverſly, or croſs the fibres. N. B. Theſe rough concretions are never found, except in ſtones that appear to have been long expoſed to the water, and turned out of their native bed. For the ſpecimens found deep under ground, although they afford beautiful congeries of cryſtals, have not any of theſe rough concretions. The rough part in the neighbourhood of A above deſcribed, had a free communication with the water when it was found.

Number LIII.

A ſmall ſpecimen ſhewing the cryſtalline matter running tranſverſly, alſo a cavity with regular formed cryſtals.

Number C.

A ſtone burnt in a culinary fire, which at firſt emitted a faint flame, but although frequently burnt afterwards, emitted no more flame, but grew red hot, and when cooled had always the ſame viſible appearance, which it has now, being white in the ſurface, and black inwardly, intirely reſembling charcoal. N. B. upon breaking this ſtone, ſo as to expoſe the internal parts, to the immediate influence of the fire, the parts immediately expoſed would become white, for this was tried in other inſtances.

Number CI. A. B.

The ſpecimen A is burnt in a culinary fire, and ſhews a near reſemblance to B, which was not burnt except by the ſolar heat upon the ſhore; in both theſe may be ſeen a rim of white matter, incompaſſing a ſeemingly black charcoal within.

Number

Number CII.

A burnt ſpecimen wherein ſome cryſtalline matter, ſtill retains a gliſtening appearance, tho' not formed into cryſtals, but diſperſt irregularly through the black part of the maſs.

Number CIII. A. B. C. D. E.

A maſs found upon the ſhores, which by rolling as the water moved it, is worn into a form ſomething orbicular. Its ſurface is white, and where a crack, almoſt inviſible, allowed moſt free acceſs to air and ſolar influence, the oppoſite ſides are white, as appears by breaking it in that part; but the reſt of that maſs internally is almoſt black. B is a ſmall ſpecimen exhibiting the ſame appearances, and alſo, the cryſtalline matter irregularly diſperſt and gliſtening. C is a ſpecimen wherein all theſe things are more diſcernible; and D is a ſpecimen ſingularly remarkable in this reſpect: It is a ſmall fragment of a large maſs, which being placed in building as the upper corner ſtone of a ſmall country houſe near the lake, it is almoſt intirely become white, having probably been expoſed to the weather in that ſituation above thirty years. E is a ſpecimen which has been ſeveral times in a culinary fire, it has a good deal of iron ore, which being ſcraped, where it appears in red ſtriæ, readily leaps to the magnet.

N. B. Some of the ſpecimens of wood petrifyed, ſo as to be totally converted into ſtone, were put into the fire, and after becoming red hot, were taken out and weighed in water, and weighed again after imbibing the fluid: from which it appeared, there were ſome combuſtible fibres of wood, which were conſumed by the fire, and thereby gave admiſſion to the water, except in one ſpecimen of the white kind, which being totally converted, ſuffered no alteration; for it is elſewhere remarked in theſe lectures, that the perfect ſtones of this kind bear a very intenſe heat without fuſion or calcination.

Number

Number CLI.

Five ſpecimens ſeemingly converted totally into ſtone

	weighed after burning lb.	oz.	weighed after imbibing water. lb.	oz.
A	4	8	4	15
B	4	2	4	11
C	2	6	2	9
D	1	1	1	2
E		15		15

Number CLII.

A vitrified crucible and burnt ſtone, deſcribed in the following experiments.

Experiments made for the Rev. Mr. BARTON.

I powdered finely two drachms weight of the ſtony matter, and the ſame weight of the woody matter; and put each into two ounces of highly rectifyed ſpirits of wine——after they had macerated for a week, I found that the woody matter had afforded the ſpirit a very ſtrong tincture, of as high a colour as common tincture of myrrh,—— this tincture had a very aromatick ſmell and taſte, and upon putting a little of it into a certain quantity of water, the water became of a milky colour,——in this mixture I found the aromatick ſmell and taſte, more manifeſt than in the tincture alone.

At the ſame time, the ſtony matter had ſcarce changed the colour of the ſpirits, nor could I perceive any difference in taſte, or ſmell, between that and plain ſpirits: And upon putting the ſame quantity of water as of the tincture in a vial; I found that mixture did not differ in taſte, ſmell or colour, from a mixture of common rectified ſpirits and water.

I put the ſtones you deſired to have calcined into a crucible, and gave it the higheſt heat that an air furnace would admit of, for the ſpace of eight hours; in which time part of the crucible, was vitrified, yet I could not perceive that the ſtones had ſuffered the leaſt change.

ROBERT DAVIES.

* The world may expect uſeful operations in Chirurgery, from the diligence and ingenuity of this young man, whoſe ſtudies are in that art.

† N. B. Theſe ſtones were petrifications of the lake, which had been burnt before in a culinary fire ſeveral times, and are to be ſeen in the collection.

Number CLII.

Friend BARTON,

I Have carefully examined that curious production thou waſt ſo kind as to make me a preſent of, and here ſend thee the reſult: It is truly a piece of wood, converted into a bituminous or metallic matter, which if it had lain long enough in its natural bed, would in all probability have loſt all appearance of wood in the ſurface, as it has entirely in the center, even as the matter of petrifications by degrees aſſumes the ſhape of vegetables ſhells &c. But that a bituminous and metallic matter ſhould act thus, is in a great meaſure new to me, and had I authority enough I would call it a *Bituminification*.

It is, in the parts that are moſt tranſmuted very ſhining, gloſſy and black, like a hardened, dry, pitchy matter; emits a white flame, and makes an agreeable fire; and two ſcruples burnt, left nine grains of black aſhes, which by the tryal with the magnet, appear to be chiefly iron.

Dublin $\frac{3}{5}$ 1750.

J. RUTTY.

This gentleman beſides honeſty and diligence, has many good qualities to recommend him, one eſpecially, that of obliging the world with many uſeful works, yet induſtriouſly hiding from fame, which muſt make him known, when his ingenious performance on mineral waters of Ireland, ſhall come into the world.

The ſequel of experiments on the bituminification, for R. B.

I took a drachm and half of the wood which had ſuffered but little change from the ſaid matter, but was ſtill chiefly woody: This was by burning, reduced to 12 grains of aſhes, which were but very little attracted by the magnet, in compariſon of the aſhes mentioned in my former experiment, by which it is evident that the aſſumption of the mineral matter into the pores of the wood is made gradually.

Charles Smith* ſhewed me from R. B. collections, a black ſtone: Its infuſion ſhews its vitriolic nature by ſtriking of a deep purple with galls.

* This gentleman is an uſeful and pains taking Inquirer, into the Natural and Civil hiſtory of his country, and has publiſhed the hiſtory of two counties Cork and Waterford.

Number CCL.

A fragment of a maſs found on the ſhore.

This ſpecimen ſhews firſt the different thickneſs of the external coat of white matter, being in one place leſs than a ſilver penny, and in another, more than double that of a crown piece. The motly appearance in one place to the depth of two inches, of black and white, and alſo the ſhining of many particles of cryſtalline matter, when viewed in ſunſhine is worth notice.

Number CCLI.

This ſpecimen ſhews not only ſtone internally but alſo internally intermixt with ſome fibrous parts of wood, which by rubbing with a moiſt finger, might be rolled into little cylinders.

Number CCLII.

This ſpecimen ſhews the external white colour, owing to the ſun and air, together with the ſame colour appearing under the exterior ſleak, where there was a communication for the air: A at the inſide ſhews this: B being internally black, ſhews that the continuity of matter, excludes the air and prevents the ſtone acquiring the white colour; where there is only a contiguity it does acquire it, as in ACD which was all covered with an exterior ſleak, but not in cloſe contact.

Number CCLIII.

This ſpccimen ſhews that all parts of the wood, which ſeem to be homogene and free from knots, do not equally admit petrification, there being firm ſtone in the center, and parallel to that, matter partaking more of wood than ſtone, and ſo alternately to the ſurface.

Number

Number CCIV.

This ſpecimen ſhews internally ſuch a intermixture of ſtony and ligneous matter, that it may be doubtful which to call it; becauſe to the ſight it appears wood, and when applied to the flame of a candle it blazes a little; and after that being applied ſeveral times, it only grows red hot without any ſenſible waſte; the thickneſs of the white ſuperficial matter alſo plainly appears, being leſs than that of a ſilver penny.

Number CCLV.

This ſpecimen found upon the ſhore is a fragment of a ſtone very hard and black, which was worn into an oval form nearly, by rolling along with the water: Upon breaking, it expoſed to view, a cluſter of ſmall cryſtals, and alſo two apartments of wood intermixt with cryſtalline matter, that ſhines beautifully when viewed through a magnifying glaſs.

Number CCLVI.

A ſpecimen of wood, wherein the calcarious matter appears in ſmall lumps.

Number CCLVII.

This ſpecimen ſhews near A, a concretion of ſand in a hollow part of the ſtone, being a different phænomenon from the ſtony matter of the reſt of the maſs which ariſes from another cauſe.

Number CCLVIII.

This ſpecimen ſhews not only wood turned into ſtone, and wood remaining in part of the maſs unconverted, but alſo ſome fibres of the wood, the remainder of more wood that was torn from it, which are quite of a different colour from the reſt, being white; whereas the firm wood is extremely brown, and the ſtone is black. The difference of colour at firſt occaſioned ſome ſurprize, and raiſed doubts about the nature of the wood, whether it be or not, what it is ſuggeſted to be.

Number CCIX.

A piece of cedar bought from a cabinet maker, in which there are two different colours. One part is of the uſual brown colour of cedar inclining to red, the other continuous to the former, is white, not unlike ordinary fir deal: One part is as fragrant to the ſmell as the former.

Number CCLX.

Is a ſpecimen of wood almoſt totally turned into a vitriolic pyrites. It was part of a very large maſs of mixt matter; part wood, part wood converted into ſtone ſome feet thick, and ſeveral feet below the ſurface of the earth, in a ſtratum hereafter deſcribed in the hiſtorical lecture.

It was diſcovered when the ſervant was putting ſome of the foſſil wood upon a chamber fire, in order to regale company with the pleaſantneſs of a fragrant ſmell, for exciting which, this wood is remarkable, as well as for chearful and durable fire; its extraordinary weight was ſufficient to occaſion its being taken notice of, and upon examining it had the appearance of a lapideſcent charcoal: For matter extremely like charcoal, could be pickt out of it, and the burning of that matter, was alſo like it. After it had lain by for ſome time, a conſiderable hoarineſs overſpread it, the matter which occaſioned it being taſted, was evidently vitriolic *(c)*. Yet the maſs did not crumble, having ſtill an intermixure of wood.

Number

(c) Aldrovandi muſæum metallicum.

In tractu Elbogano, ad oppidum, quod a planitie Falconum nomen habet inventæ ſunt permagnæ abietes lapideæ naturæ una cum corticibus, in quorum rimis pyrites concreverant. Page 854. tabella VIII. monſtrat duas icones, quarum prima refert arundinem, ſeu fruſtã ejuſdem, ſecunda icon oſtendit caulem fœniculi in lapidem duratum; foramen, nodos, venas, et nervos habet, quæ omnia in vegetabili caule fœniculi obſervantur. Verum non debent aliqui hæſitare, an hic caulis revera fuerit converſus in lapidem, quoniam natura lapides etiam plantas et caules formare poteſt, cum plantas, quæ vegetabilia ſunt perfectiora generare poſſit. Quapropter, in hoc caſu, argumentum a majori ad minus probandum, et admittendum eſt.

Theſe quotations from Aldrovandus ſhew, that his copious collection of ſpecimens of petrifications, are inferior to the collection of which there is here a catalogue partly given. For many of theſe petrifications, contain ſtill the ligneous matter naturally continuous to the matter metamorphoſed into ſtone: which muſt be more convincing to inquirers, than

any

Number CCLXI.

B 1 B 2 B 3 in plate 4. p. 55. are three different repreſentations of the parts of the maſs, containing wood, ſtone and cryſtal. B 1. is the view of one ſide and one end of the maſs; in which *a b* denotes a line of cryſtal, *c d* a crack dividing a maſs of cryſtal of the ſhape *c d e f*, in which from *cd* there are, as it were lines of cryſtal parallel to *h f* on one ſide

any argument drawn a majori ad minus. Aldrovandus uſed that argument, it is likely, becauſe he never ſaw one ſpecimen of wood and ſtone naturally continuous. His ſtyle in many caſes implies this, abieties lapideæ naturæ, and Tab. V. 861. refert expreſſam imaginem cujuſdam fruſtri lapidei ponderoſi, quod fortaſſis olim fuit lignum, and ſuch like. The works of this pains taking writer, were not within the reach of the Author of theſe Lectures, till they were in the preſs; at which time he could not ſearch as diligently into Aldrovandus, as others may. But Aldrovandus's accounts are rendered more probable, by what has been related here; Yet perhaps two of the following may be liable to exception.

Majori admiratione teneri debemus, dum res etiam tenellæ, ut fructus, et fungi lapideſcant. Habuimus enim fungum lapideum abſque pediculo, ex Cairo allatum.———Nam in mari prope Cairum, multa lapideſcunt. Muſ. Met. 856.

All the marine productions like muſhrooms, of which the Author of theſe Lectures has ſeen many, and has had the property of ſome, have the ſtalk on the oppoſite ſide to that which is natural to the vegetable muſhrooms of the land.

Tabella VIII. eſt valde admiranda, quoniam repræſentat triplex lythoxylon, nempè fragmentum caſtaneæ, quercus et ulmi in lapideam formam transformatum.

Tab. XII. Habet delineatum arboris incognitæ corticem pariter petrificatum, fuiſſe olim corticem arboris cognovimus, quoniam facile in particulas corticeas ſcindebatur, quemadmodum aliquando in arboribus obſervavimus, quarum cortices alium corticem internum amplectantur.

It will be hereafter obſerved, that all the petrifications which make part of the ſubject matter of this book, there is not one ſpecimen of bark petrified.

The two following accounts alſo ſhew, how doubtful he was, whether the ſpecimens before him were real petrifications, or not.

Tabella 9. Paleas oſtendit petrificatas. Prima icon indicat ſtipitem habitum ex montibus Vicentinis, nomine paleæ petrificatæ. Quandoquidem circa illum montem, lacus conſpicitur, cujus aqua res lapideas reddit: Nihilominus non videtur aliqua ſpecies paleæ, ob craſſitiem; cum noſtræ paleæ non tam craſſæ appareant. Præterea palea eſt glabra, et lævis; hic autem caulis eſt ſcaber, et inæqualis. Quamobrem, ut noſtra fert opinio, hic caulis ad ſtipitem lapideum vel ſtelechitem reducendus eſſe videtur, Quamvis autem ſtelechites ut plurimum cavus non ſit, aſſerendum erit hoc fruſtrum ſtipitis, vel bacilli, hanc cavitatem accidentalem acquiſiviſſe. Aut etiam fieri potuit, ut hic ſtipes a natura, abſque ulla tranſmutatione, genitus fuerit.

Sub

ſide of *c d*, and parallel to *h e* on the other. B 2. repreſents the face of a ſection of the maſs, in which *ab* ſhews the cryſtalline matter penetrating into the maſs of the ſame form as in B 1.—B 3. repreſents the face of the other ſection, in which *b e* ſhews the line of cryſtal mentioned, *b a* and *de* lines of cryſtal running perpendicular to one line of diviſion

Sub numero 2. 3. 4. Paleæ genuinæ petrificatæ deſignantur: Cum ex magnitudine, cortice, figura, et foramine tales eſſe colligendum ſit. Hæc enim omnia, has veras fuiſſe paleas demonſtrant. Deinde duæ ſimul copulatæ, et petrificatæ conſpiciuntur. Pariter aliæ majores, et aliæ minores apparent. *Tandem addamus quod nihil prohibere poteſt, quin natura abſque petrificatione, talia generare potuerit,*

Mithologica, ex Aldrovando,

Neque fabulares hiſtoriæ ab hoc capite ſunt arcendæ, quoniam et ipſæ multa lapideſcentia memorant. Itaque ſerpens ille, apud Homerum, poſt novem paſſeres devoratos in lapidem mutatus fuiſſe perhibetur, qui gloriam captæ Trojæ, nullo unquam tempore, perituram eſſe ſignificabat. Inſuper fabulatores Poetæ monimentis etiam mandarunt, intuentes ſcutum Minervæ effigiatum capite Gorgonis Meduſæ, illicò lapideam naturam adipiſci; Idcirco Reuſnerus quandoque huc reſpiciens ſic canebat.

Dum movet injuſtum Phineus in Perſea bellum,
Multaque fert hoſtis vulnera, multa facit:
Gorgone cum ſociis viſa ſtupet illicò, tandem
Hic lapis immotus fit rigiduſque ſilex.

‘ Amplius poetæ fabulantur Niobem filiam Tantali, ſororem Pelopis, et uxorem Amphionis, ingenti dolore, ob interitum filiorum, agitatam, in ſaxum converſam fuiſſe: quandoquidem ipſi fingunt omnes illius filias, et filios ſagittis Apollinis, et Dianæ fuiſſe peremptos. Thus much Aldrovandus ſays of mythology.

Noſtri catalogi ſpecimina primùm ſub diſtinctione Mythologicâ ad claſſes reducta fuit.

Specimina ligni et lapidis continui titulum habuerunt (HERMAPHRODITUS).

Specimina ligni in lapidem prorſus converſi titulum habuerunt (CÆNEUS),

Specimina ligni neutiquam mutati titulum habuerunt (CÆNIS).

Specimina materiæ ligneæ lapideæ et ferrugineæ in eâdem continuâ maſſa titulum habuere (HEPHAISTO-HERMAPHRODITUS).

Sed quoniam ingenium fabulis non rebus aptum iſtius-modi nugæ arguunt rejicere placuit.

More regard ſhall be paid to Aldrovandus his moral reflections, becauſe the ſcriptures have often alluded to ſtones, to denote moral hardneſs or inſenſibility of divine inſtructions.

MORALIA.

Moralis doctrina etiam a lapideſcentibus documenta percipit. Namque velut plantæ in undis nonnullorum fluviorum merſæ lapideſcunt: Ita nonnulli in flumen criminis verſantes, omnem humanitatis ſenſum amittunt, et pectora prorſus ſaxea induunt, ita ut ſpecie

viſion or crack and *g f* wood with ſeveral cracks in it, perpendicular to the direction of the fibres of the wood, in all which there are little thin plates of cryſtal; this part of the maſs is very brittle in all the little cryſtalline partitions; *h e* is an extraordinary congeries of matter, which to the

ſpecie tantum homines videantur. Quamobrem Divus Bernardus hos meditatus dixit, in his cor eſſe, quod compunctione non ſcinditur, nec pietate molitur, nec precibus movetur, nec minis cedit, flagellis duratur, fitque ingratum ad beneficia, infidum ad conſilia, ſævum ad judicia, inverecundum ad turpia, impavidum ad pericula, et inhumanum ad humana. Quamobrem non poſſumus, quin hujuſmodi cor lapideum indigitemus. Quapropter, in hoc caſu, criminoſi ad ſolum Deum omnium aquarum, et lapidum gubernatorem confugere ſe debent, qui apud Ezechielem, hæc verba protulit. Et dabo eis cor unum, et ſpiritum novum tribuam in viſceribus eorum, et referam cor lapideum de carne eorum, et dabo eis cor carnis ut in præceptis meis ambulent. Etenim hac ratione ſceleris limum, æſtum fomitis, gelu acediæ, ſalſuginem avaritiæ, fluctum inconſtantiæ, ſpumam faſtus et arenas diſſolutionis arcebunt: Quinimo eorum cor, audita voce divina, impoſterum non obdureſcet.

Muſæum Metallicum ALDROVANDI.

Since there is a juſt foundation for moralizing upon theſe and all ſubjects of natural philoſophy, it is hoped, the reader will accept of Lord Verulam's ſentiments.

‘ Sequitur parabolæ pars inſignis. Homines loco gratulationis et gratiarum actionis, ad
‘ indignationem et expoſtulationem verſos eſſe, atque accuſationem et Promethei et ignis
‘ apud Jovem inſtituiſſe; eamque rem Jovi acceptiſſimam fuiſſe, adeo ut hominum com-
‘ moda ob hoc novâ munificentiâ cumulaverit. Quorſum enim iſta criminis ingrati erga au-
‘ thorem ſuum animi (quod vitium omnia ferè complectitur) approbatio et remuneratio?
‘ Res aliò ſpectare videtur. Hoc enim vult Allegoria; incuſationem et naturæ ſuæ, et
‘ artis per homines factam, ex optimo mentis ſtatu proficiſci, atque in bonum cedere;
‘ contrarium Diis inviſum, et infauſtum eſſe. Qui enim naturam humanam vel artes
‘ receptas in immenſum extollant, et effuſi ſunt in admirationem earum rerum, quas ha-
‘ bent et poſſident, et ſcientias quas profitentur, aut colunt, perfectas prorſus cenſeri vo-
‘ lunt, illi primo adverſus divinam naturam minus reverentes ſunt, cujus perfectioni ſua
‘ ferè æquiparant: Deinde iidem erga homines magis ſunt infructuoſi, cum ſe ad faſtigium
‘ rerum jam perveniſſe putent, et tanquam perfuncti ulteriora non quærant. Contrà qui
‘ naturam et artes deferunt, et accuſant et quærimoniarum pleni ſunt, illi verè et magis
‘ modeſtum animi ſenſum retinent, et perpetuò ad novam induſtriam, et nova inventa ex-
‘ timulantur. Quo mihi magis mirari libet hominum inſcitiam, et malum genium, qui
‘ paucorum arrogantiæ ſervuli, iſtam peripateticorum philoſophiam, portionem Græcæ
‘ ſapientiæ, nec eam magnam, in tanta veneratione habent, ut omnem ejus incuſationem,
‘ non ſolum inutilem ſed ſuſpectam et ferè periculoſam reddiderint. Atque magis proban-
‘ dus eſt, et Empedocles, qui tanquam furens, et Democritus qui magnâ cum verecundiâ,
‘ quæruntur, omia abſtruſa eſſe, nihil nos ſcire, nil cernere, veritatem in profundis puteis
‘ immerſam, veris falſa miris modis adjuncta atque intorta eſſe (nam academia nova mo-

‘ dum

the eye appears like a hardened clay, but viewed with a glaſs, evidently ſhews many ſmall tubes of cryſtal penetrating the maſs in various directions.

This ſpecimen not above two pounds weight, is well worth the attention of a philoſopher.

Number CCLXII.

Fig. C in plate 4. p. 55. is no more than the handle of a walking ſtaff of ſound wood, covered with a hard ſtony concretion, intermixt with ſhells, which was found at the at black rock near Dublin; and is inſerted

' dum prorſus exceſſit) quam Ariſtotelis ſchola fidens et pronunciatrix. Itaque monendi
' ſunt homines, delationem naturæ et artis Diis cordi eſſe, et novas eleemoſynas, et donaria
' à divinâ benignitate impetrare, et incuſationem Promethei licet authoris et magiſtri, eam-
' que acrem et vehementem magis ſanam et utilem, quam gratulationem effuſam eſſe:
' Denique opinionem copiæ inter maximas cauſas inopiæ reponi.
Prometheus, ſive ſtatus hominis. Verulam.

There are thoſe who think many ſubjects in natural philoſophy exhauſted, the deſign of this quotation, is to ſhew how weak ſuch opinions are; and is authority for the publication of this book upon petrifications, &c. For the ſake of thoſe who do not underſtand latin, the tranſlation into Engliſh is given alſo.

' There follows next a remarkable part of the parable, that men inſtead of gratulation,
' and thankſgiving, were angry and expoſtulated the matter with Prometheus, in ſo much
' that they accuſed both him and his invention unto Jupiter, which was ſo acceptable unto
' him, that he augmented their former commodities with a new bounty. Seems it not
' ſtrange, that ingratitude towards the author of a benefit (a vice that in a manner con-
' tains all other vices) ſhould find ſuch approbation and reward? No, it ſeems to be other-
' wiſe. For the meaning of the allegory is this, that mens outcries upon the defects of
' nature and art proceed from an excellent diſpoſition of the mind, and turn to their good,
' whereas the ſilencing of them is hateful to the Gods, and redounds not ſo much to their
' profit: For they that infinitely extol human nature, or the knowledge they poſſeſs,
' would have them be accounted perfect; they do firſt of all ſhew little reverence to the
' Divine Nature, by equalizing, in a manner, their own defects with God's perfections:
' Again they are wonderfully injurious to men, who imagining they have attained the higheſt
' ſtep of knowledge (reſting themſelves contented) ſeek no farther. On the contrary, ſuch
' as bring nature and art to the barr, with accuſations and bills of complaint againſt them,
' are indeed of more true and moderate judgments: For they are ever in action, ſeek-
' ing always to find out new inventions. Which makes me much to wonder at the fooliſh
' and inconſiderate diſpoſitions of ſome men, who (making themſelves bond ſlaves to the
' arrogancy of a few) have the philoſophy of the peripatetics (containing only a portion

' of

inſerted here only to ſhew the diſpoſition in the ſea, to concrete matter and form ſtone. For there will be more than once occaſion to mention that hereafter.

N. B. All wood, when fully ſaturated with water will ſink. For the ſpecific gravity of wood quatenus wood is heavier than water; when therefore its cavities are filled with water inſtead of air, it ſinks. In this manner this wood ſinking had a ſtony concretion formed at the bottom of the ſea, and was rolled to the ſhore afterwards.

Plate 7. fronting Lecture VI. repreſents ſeveral kinds of ſhells, all petrefied except Fig. 1. which is the exact form and ſize of the pearl muſcle ſhell of Lough Neagh. For ſome of the rivers flowing into this lake, particularly the river Ban were of old eſteemed for the production of pearls; but the price of pearls is ſo much depreciated of late, by a nice imitation of them by means of the ſcale of a fiſh incompaſſing wax, or ſome other matter, that little ſearch is made for them. *In the ſame manner hypocriſy is depreciating true virtue, in the moral world.*

The ſhells repreſented in Fig. 3, 4, 5, 6, 7, as converted into ſtone, are in great plenty in the neighbourhood of the lake. Fig. 3. and 5. were ſtruck out of flints; and Fig. 2. ſhews not only an Echinus parted from the flint, but the bed alſo in which it lay in the rough maſs.

Fig. 4. and 6. were dug out of clay, within one foot of the ſurface of the earth, where a cart might be loaded in a day's time, by the labour of four men. Fig. 7. is the form of a ſhell filled with ſand, and got in a ſand pit, in a very high piece of ground, where a great quantity

‘ of Grecian wiſdom, and that but a ſmall one neither) in ſo great eſteem, that they hold it,
‘ not only an unprofitable, but a ſuſpicious, and almoſt heinous thing, to lay any impu-
‘ tation of imperfection upon it. I approve rather of Empedocles his opinion (who like
‘ a mad man, and of Democritus his judgment, who with great moderation complained
‘ how that all things were involved in a miſt) that we knew nothing, that we diſcerned
‘ nothing, that truth was drowned in the depths of obſcurity, and that falſe things were
‘ wonderfully joined and intermixt with true (as for the new academy that exceeded all
‘ meaſure,) than of the confident and pronunciative ſchool of Ariſtotle. Let men there-
‘ fore be admoniſhed, that by acknowledging the imperfection of nature and art, they are
‘ grateful to the Gods, and ſhall thereby obtain new benefits and greater favours at their
‘ bountiful hands, and the accuſation of Prometheus their author and maſter, (though
‘ bitter and vehement) will conduce more to their profit, than to be effuſe in the congra-
‘ tulation of his invention: For in a word, the opinion of having enough, is to be ac-
‘ counted one of the greateſt cauſes of having too little.

might be pickt in the face of a pit dug to the depth of twenty feet. Theſe do not make part of the catalogue of the vendible ſpecimens, becauſe the Inquirer has reaſon to think they are not uncommon in other countries; For ſome of theſe were afterwards found at fifty miles diſtance from the lake.

N. B. The Inquirer has broken a great quantity of flints, and thereby has enabled himſelf to make many obſervations, which he does not think proper to communicate here; becauſe his deſign is to limit himſelf as much as he can, to ſuch things as may be deemed new, as he preſumes the petrifications are. And although the account of gems and cryſtals immediately following, be not new to good natural philoſophers elſewhere, yet the diſcovery of them in the ſhores of Lough Neagh, certainly is new.——And upon that account they are made part of this book.———

Since we are now quitting one part of our deſign, to wit, the catalogue of the metamorphoſes; a quotation ſhall be laid before you, the reaſon for which will appear from what ſhall be ſaid upon it.

Varenius his geography, with the improvements of Newton, Jurin, Dugdale, Shaw, London, 1734. Chap. 17. Propoſition XI.

‘ There are ſome waters which petrefy wood or turn it into hard ‘ ſtone.

‘ A little above the city of Ardmagh in Ireland, there is a ſmall lough, ‘ in which if a ſtick of wood be fixed, and continue for ſome months, ‘ the part that is faſt in the mud becomes iron, that in the water turns ‘ to a whetſtone, and that above water continues to be wood. This ‘ is reported by Giraldus and Maginus: But Brietius, by what authority ‘ I know not, ſays, that it is a fable throughout. In the north of Ulſter ‘ (a province in Ireland) there is a fountain, in which if wood be im- ‘ merſed ſeven years, it will be petrefied.

‘ To this there is a note annext,

‘ There is certainly no ſuch lough in Ireland; Their famous Lough ‘ Neagh was formerly thought to have a petrefying quality; but upon ‘ due examination it is found, that the ſaid quality is to be aſcribed ‘ to the ſoil or the ground adjacent to the lake, rather than the water ‘ of the lake itſelf *(m)*.

As

(*m*) See alſo the opinion of Mr. Buffon of Paris, in the beginning of next Lecture.

As to the quality of the lake, it is part of the buſineſs of the fifth lecture to diſcourſe upon it. But whereas the account of the ſmall lough near Ardmagh, juſt mentioned, may ſeem to be a miſapplication of the old traditionary account of Lough Neagh; the Inquirer thinks proper to inform you, that he does not apprehend that this is the caſe; for there was once a ſmall lake within two miles of that city, which might have that character. The place where Mr. Maxwel an ingenious miniſter amongſt the Presbyterians lives, is likely to be the place which is meant in this paſſage. For that Gentleman's houſe ſtands on an eminent piece of ground, incompaſſed with a flat which was all covered with water, when he began to improve it. And upon diſcharging the water, which was done without much expence (as moſt flow bogs in Ireland are capable of being drained, to the advantage of the proprietors) and very much to his advantage as a farmer, in which he is extremely ſkilful and ſucceſsful, he diſcovered abundance of materials for the philoſopher: And has very often ſurprized Mr. Hutchinſon of Glaſcow, with phænonema of petrifications, which were deemed well worth the expence of carriage to Glaſcow. This Gentleman in the firſt place, built his houſe with petrifications, on the ſummit of the iſland, for ſuch it is called in the Iriſh language. He raiſed abundance of marle, whereby he has inricht his land exceedingly, and yet enjoys it upon reaſonable terms, from the preſent generous Lord Primate, who ſcorns to take advanced profits of a tenant's labour and ingenuity, and whoſe look upon a thriving tenantry does not faſcinate *(n)*, but enliven. This worthy Gentleman is almoſt able to give ocular proof of the modern generation of Marle, and can not only ſhew the ſhells with living fiſh in them, whoſe congeries make marl, but could alſo once ſhew ſome of the large ſhells whoſe kinds petrefied in that place, make now the walls of his houſe. He was ſo kind as to promiſe once to give an account of theſe things in writing, but that not being done, this is ſaid here in order to ſpirit him up to it. The Inquirer will here alſo take the liberty to tell, that the worthy Gentleman mentioned, was employed by the Univerſity of Glaſcow about twelve years paſt, to procure a ſpecimen of wood and ſtone continuous of Lough Neagh. For notwithſtanding his own farm abounded with ſuch plenty of petrifications, he never got one of the kind mentioned.

(n) Neſcio quis teneros oculus mihi faſcinat agnos. Virgil.

He inquired diligently but without ſucceſs; he even aſſembled about forty perſons at Stewart's town in Tir-Oen, all inhabitants of the ſhores of the lake, and depoſited a moydore in the hands of a gentleman, to be given to the peaſant who would bring a ſpecimen of the kind. A year after that, the money was reſtored, and he deſpaired of ever getting it, looking upon the traditional account as an idle fable; till about four years paſt he had an opportunity of ſeeing the collection, a catalogue of part of which is given in the foregoing ſheets;—and a rationale in ſome of the following.

Syringoides, or pipe ſtone.

Having a large collection of theſe, with which many other places of the world abound alſo, they do not make any part of the catalogue of ſpecimens, which are intended for ſale (they, of which theſe lectures principally treat, being of the rare kind, and peculiar to the lake,) and few are therefore numbered: Some icons are given of them in plate 6. fronting Lecture V. which may be obſerved there, no more being neceſſary to be remarked upon them than that figures 1, 2, 3, 4, are all of the ſyringoides kind. Fig. 2. has along with the pipes variouſly contorted, ſeveral ſhells alſo, and all adhere to an homogene flat ſtone. Fig. 3. is a pipe ſtone corroded in ſuch a manner, as to leave hexagonal and pentagonal cells, in ſo much that a haſty obſerver would call it a petrefied honey comb: But whereas the bees are too accurate geometricians, to vary from their mathematical inſtinct, which directs them to the uſe of hexagonal cells, and in this ſpecimen, as the obſerver may count, there are ſeveral pentagons. This is therefore not a petrefied honey comb *(o)*.

Fig. 4. is a moſt beautiful flint with ſtellate appearances, paſſing quite through the maſs, and alſo cells of the former kind, pentagonal, and hexagonal, very evident to a cloſe obſerver, (tho' it ſeems they were neglected by the etcher) which cells being filled with a very hard matter as right flint is, take a fine poliſh, and exhibit a beautiful ſcene to the human eye: N. B. This laſt ſpecimen belongs to the collection of the Rev. R. Pococke.

The

(o) Mr. William Aſh-rainey brought a ſpecimen to the Author of this kind, when the work was in the preſs, found in the County of London-Derry, very near the ſhore of the lake, by his workmen, when they were turning up clay for brick. The ſame remarks belonging to this, as to the former ſpecimen, they need not be repeated. The Gentleman mentioned, is intitled to a preſent of one of theſe books for this civility.

The lapis ſyringoides or pipe ſtone, is found frequently upon the ſhores of Lough Neagh, and theſe ſtones are in all probability meer petrifications of the complicated roots of ſome plants. One ſpecimen before you looks like a cluſter of worms intangled with one another, (ſee fig. 2. plate 6. lecture 5.) but compared with that * root gives reaſon to think it was a parcel of roots ſimilar to that petrefied.

Number CCLXIII.

This ſpecimen was found at ſome diſtance from the lake, in a bed of clay: What is moſt obſervable in it is, that the pretreſcent matter has become hard between the roots of the plant, and made a very firm ſtone; whereas the root itſelf became only a looſe gritty matter, ſcarce ſo compact as that of brick, which may be eaſily pickt out with the grain of a fleſh-fork, leaving in the place of it a perforation through the ſtone. Very large ſpecimens of this kind, have been found with great abundance of holes paſſing through the body of the ſtone.

Number CCLXIV.

There is in the cuſtody of Mr. James Simon of this city, and a fellow of the Royal Society, a piece of wood petrefied in the ſea, and found in the harbour of Dublin, in the year 1745. Upon breaking this, a fiſh was found petrefied in it; I ſay petrefied, complying with the vulgar expreſſion, although nothing remains but the fiſh bones petrefied, and a gloſſy appearance like the ſlimy ſurface of a fiſh. This fiſh penetrated into the crack of the timber, being the rib of a wreckt ſhip, and the ſtony matter concreting about it, the cavity is filled with a looſe gritty ſubſtance, with the form of the fiſh in it, the eſculent part ſoon vaniſhing by putrefaction, which is generally quicker than petrification, nothing remained to make an impreſſion but the bones, and perhaps a ſkin. The reſt of the maſs is firm ſtone, which once had been wood, as is indiſputable to any one who ſees the ſpecimen, having mortices, auger holes, &c.

This opens the way to a ſolution of all the appearances of fiſhes in ſtone, found in many parts of the world, and attributed to the deluge.

Moſt

* Here the Inquirer ſhewed a root found in a gravel pit at a great depth, unconverted; Mr. Tull in his husbandry ſomewhere ſhews that the roots of St. Foin, penetrate even rocky ground more than four and twenty feet.

Moſt of which appearances are like this; not but the ſame gentleman can ſhew alſo the body of a fiſh petrefied, which he took out of a lime ſtone quarry at Rahenny near Dublin; in which the body ſeparated eaſily from the incompaſſing maſs, and ſhews ſeveral laminæ, to wit, 12 in the length of two inches and an half towards the tail, diſtinguiſhed by thin ſtriæ of a white ſparry matter, the reſt being a grey ſtone. N. B. Cod and whiting boiled break into flakes of the like form; and in this inſtance putrefaction was not quicker than petrification.

This Gentleman who has theſe ſpecimens, has made a fine collection, and his ingenuity being equal to his diligence and ſucceſs in ſearches, it is pity he is not better rewarded.

In the ſame quarry, the ſame gentleman found a piece of a bone lodged in clay, which made a ſtratum between ſtrata of ſtone, at leaſt twenty feet deep. It is difficult to determine whether this was the bone of a fiſh, or a land animal: But that it is now a bone there can be no doubt to any one who ſees it, and chews it. In a quarry at Harold's Croſs near this city, the ſame Gentleman alſo found a bone in a ſtratum of clay, being a much larger ſpecimen, but equally difficult to be claſſed with ſea or land animal parts.

Number CCLXV.

Is the half of a calculus humanus, taken out of the bladder of a man who died of the diſorder in the town of Lurgan: The whole ſtone weighed very near eight ounces.

Number CCLXVI.

A ſmall calculus humanus, produced in the lungs of a certain Gentleman of the ſame town, who coughed it up a little before he died. This ſtone is in the cuſtody of the Gentleman above mentioned; and was given to him by the Author of theſe lectures *.

GEMS

* There was a curious ſpecimen of petrification of another part of animal ſubſtance, found lately in a marle pit within three miles of the lake, it is the jaw of one of the Mooſe Deer, the horns and bones of which creature are frequently met with in ſuch places in this kingdom: But although the whole ſkeleton of the creature was found in the ſame bed, yet no part was petrefyed except the teeth, they being plainly turned to ſtone, as appeared from the experiment of ſcraping them into a dry gritty powder with a knife. The jaw was extremely hard, and nearly approaching to the nature of ſtone. A petrefied tooth was alſo found on the ſea ſhore, called the Murragh near Wicklow.

GEMS.

Prime chearer LIGHT!
Of all material beings, firſt, and beſt!
Efflux divine! Nature's reſplendent robe!
Without whoſe veſting beauty all were wrapt
In uneſſential gloom; and thou red SUN,
In whoſe wide circle worlds of radiance lie
Exhauſtleſs brightneſs, may I ſing of thee!

At thee the RUBY lights his deepning glow,
A bleeding radiance, grateful to the view.
From thee the SAPHIRE, ſolid æther, takes
His hue cærulean; and, of evening tinct,
The purple ſtreaming AMETHYST is thine.
With thy own ſmile the yellow TOPAZ burns.
Nor deeper verdure dies the robe of ſpring,
When firſt he gives it to the ſouthern gale,
Than the green EMERALD ſhews. But all combin'd,
Thick through the whitening OPAL play thy beams;
Or flying ſeveral from its ſurface, form
A trembling variance of revolving hues.
As the fire varies in the gazer's hand.

Thomſon's Summer.

Had ſhe been true
If Heaven could make me ſuch another world,
Of one intire and perfect CHRYSOLITE,
I'd not have ſold her for it. Shakeſpear's Othello.

Number CCLXVII.

A Pſeudo Adamas weighing two pounds two ounces, delineated Plate 6. fronting Lecture 5. Fig. 5. in which the ſurfaces and angles are repreſented, but diminiſhed: And whereas there are thirteen ſurfaces graved, it is moſt probable that it had only twelve; for the part which ſeems the root is delineated alſo; and ſhould not properly be reckoned one, according to the uſual manner of cryſtalline hexagons. For this

body

body, which might by others be called a cryſtal, is here denominated as above: Becauſe having cut and broken it into ſeveral blocks for mechanical uſes, which ſhall be related hereafter, it has a finer luſtre and is harder than thoſe brought from abroad, or found in other parts of this kingdom, and therefore deſerves an intermediate name between cryſtal and a diamond.

Number CCLXVIII.

Another Pſeudo Adamas weighing half an ounce, of an orbicular ſhape, and covered with an opaque ſcurf; as hard as the former and of as fine, or finer a luſtre: For the opinion of artiſts differ.

Number CCLXIX.

A Mocoa weighing one pound, extremely rough and irregular in the ſurface, ſo uninviting to the ſight in its external appearance, that if the accidental breaking of it in a place where other ſtones were handled, had not diſcovered the inward beauty, it would not have been lifted. The beauty of this ſtone ſhall be deſcribed in the phyſico-mechanical lecture.

Number CCLXX.

A Carnelian, weighing three quarters of a pound, of an oval form, exactly appearing externally like raw fleſh, as Caro the origin of Carnelian denotes; it poliſhes to great beauty as ſhall be explained in the phyſico-mechanical lecture.

Number CCLXXI.

Another Carnelian, being a ſmall fragment of a much greater maſs, is only a quarter of a pound weight, of a pure amber colour without any appearance of fleſh---The uſes of this are told in the phyſico-mechanical lecture *.

* N. B. The foregoing catalogue is given honeſtly, tho' not very regularly, (and the cryſtals and agats ſhall be deſcribed in the phyſical, and phyſico-mechanical lecture) In this catalogue, regard was had to a noble precedent the Royal Society, ſee their hiſtory page 115. by the Biſhop of Rocheſter.

'The Society has reduced its principal obſervations into one common ſtock; and laid 'them up in public regiſters, to be nakedly tranſmitted to the next generation of men; 'and ſo from them, to their ſucceſſors. And as their purpoſe was, to heap a mixt maſs of 'experiments, without digeſting them into any perfect model; ſo to this end, they confined 'themſelves to no order of ſubjects; and whatever they have recorded, they have done it not 'as complete ſchemes of opinions, but as bare unfiniſh'd hiſtories.

THE

HISTORICAL LECTURE,

OR THE

HISTORY

OF THE

Phænomena of Lough Neagh,

With regard to places and ſtrata of matter, whether Lake or River or Springs, Land or Water, deep or ſuperficial.

LECTURE IV.

Ad quæ noſcenda iter ingredi, tranſmittere mare ſolemus; ea ſub oculis poſita negligimus: ſeu quia ita naturâ comparatum eſt, ut proximorum incurioſi, longinqua ſectemur: Seu quod omnium rerum cupido langueſcit, quum facilis occaſio eſt; ſeu quod differimus, tanquam ſæpe viſuri quod datur videre, quoties velis cernere. Quacunque de cauſâ, permulta in urbe noſtrâ juxtaque urbem non oculis modo, ſed ne auribus quidem novimus: Quæ ſi tuliſſet Achia, Ægyptus, Aſia, aliave quælibet miraculorum forſan commendatrixque terra, audita perlecta luſtrataque haberemus; ipſe certe nuper quod nec audieram antè, nec videram, audii pariter et vidi &c. Plin. Epiſt. Gallo ſuo lib. 8.

Goldſmiths that only give ſhape and luſtre to gold, are far more eſteemed, and in a better condition than miners, who find the ore in the bowels of the earth, and with great pains and induſtry dig it up, and refine it into metal: So thoſe that with great ſtudy and toil ſucceſsfully penetrate into the hidden receſſes of nature, and diſcover latent truths, are uſually leſs regarded, than thoſe who reduce the truths, that others have found out, into ſyſtems.

Boyle's Excellency of Theology compared with Philoſophy.

In hoc gaudeo aliquid dicere ut doceam: Nec me ulla res delectabit, licet eximia ſit et ſalutaris, quam mihi uni ſciturus ſim. Si cum hac exceptione detur ſapientia, ut illam incluſam teneam, nec enunciem, rejiciam. Senec. Ep. 6.

La curioſité n'eſt que vanité. Le plus ſouvent on ne veut ſcavoir que pour en parler. On ne voyageroit pas ſur la mer pour ne jamais en rien dire, et pour le ſeul plaiſir de voir, ſans eſperance de s'en' entretenir jamais avec perſonne. Paſch. Vanité de l'homme.

ADVERTISEMENT.

THE foregoing lectures were not read, becauſe the Gentlemen were impatient to be made acquainted with the diſcoveries. The addreſs therefore uſed upon that occaſion, and immediately before the reading of this lecture, is printed alſo immediately before it. For ſome readers will rather chuſe to paſs over the principles, or take them for granted, than be detained by ſtrictneſs of demonſtration from gratifying an eager curioſity. Yet to ſuch, the INQUIRER recommends the previous reading of the lecture of metamorphoſes, that being abſolutely neceſſary to Readers, tho' not ſo, to Spectators.

ADDRESS.

GENTLEMEN,

THE honour which you are doing to the ſubjects which are to be treated in your preſence, and to the perſon who has undertaken the taſk, demands an acknowledgment previous to every thing elſe.

Should this be neglected, a favourable judgment of the performance might juſtly be forfeited. When knowledge is rated below its value by many, the ſearchers into it ſhould highly eſteem thoſe, who pay regard to their ſearches. Approbation being a laudable encouragement to human actions, it is never more ſo, than when it proceeds from the opinion of the diſcerning few. That which is commonly called taſte, and adorns a character in one point of view, is a facility of right judgment in a particular art. The *Painter*, *Statuary* and *Poet*, are ſpirited in the execution of their works, by the taſte of thoſe, who juſtly admire their arts: And he who means to examine the material world, for the arcana of nature, is happy in finding thoſe, who may approve his pains, elſe he may grow languid in the purſuit.

Such you have declared yourſelves, and as ſuch, you are highly eſteemed by him, to whom you have done honour; whoſe ambition, after profeſſing his gratitude, is to deſerve that approbation, which you have ſhewn ſo prompt a diſpoſition to give.

MAPS hitherto published of a famous fresh
of IRELAND, called LOUGH NEAGH, which i

Grierson

Colerain

Ban Flu.

L. Beg

Main Flu.

Six Mile River
or Antrim River

Ban Flu.

L. Beg

Spee

Moyola Flu.

Camlin or Crumlin Flu.

Fall

Fall 30 Feet.

Fort Toom

Glenwy River

Balinderry Flu.

LOUGH

NEAGH

LAUGH N

Tallonven
Flu.

The Stone
where Oneil
is Crowned.

Enis

L. Beg

Sidney
Island

Fort
Montjoy

Black Water

Oneiland
County

Cl
Br

Black water Flu.

Ban Flu.

Colerain

L.
Eriphia
Beg

Main River

Canal
C. Ter-owen

Dungannon

Canal Petty.

Balinderry

Clale Water

Nenry

Black Water

Lurgan

Sego

Nenry

S. Wheatley Sculp.t

nous fresh Water Lake in the North
GH, which is about 60 Miles round.

Speed's Theatre
1676.

Mercator.

Colerain

Banna Fl.

C. Thome

LACUS

EAGH.

AUGH NEAGH.

Enis Garden

Brasilogh

Terlogh

Sidney Island

Clan Brasil

Moreval Magnus Flu.

Gallym Flu.

Ardmagh

Cothe Flu.

Little Ban Flu.

Banna Flu.

Colerain

Bann R.

Morden.

Bleau.

Antrim

Drumbo the Stone where Oneil is chosen.

L. NEAUGH

Innis Garden

Sidney Island.

Sidney

R. Black Water.

Fort Charles

Kasin Flu. Terlogh Brasilogh Oneiland County

Dalgan Flu.

Brasil

Ban R.

Cushor Flu.

Lurgan

LECTURE IV.

THE papers which have been written, and publiſhed in the philoſophical tranſactions of the Royal Society upon the ſubjects now to be treated, are a ſufficient proof of the admiration which they have excited in the minds of the curious; and are therefore a proper apology for theſe Lectures; which ſhould have been ſpared, if former inquiries had been ſucceſsful. Since every particle of matter affords a large fund of meditation to the wiſeſt man, ſuch congeries of them, in forms extremely different from the common aſſociations of matter, deſerve attention in a ſingular manner. For ſuch rare phænomena ſeem providentially to be ſcattered through the univerſe, to awaken mankind from that kind of ignorant lethargy, which an unchangeable uniformity is apt to occaſion.

We look at the daily ſun without any ſurprize, and the regular returns of darkneſs with the ſame unaffecting indifference; but ſuch a day as *Joſhua* ſaw could rouſe mankind to attention, and a ſhort night of eclipſe can awaken the mind to the ſtudy of nature.

Was it common for ſtones to vegetate in form of plants, or for matter to be caſt in pillars imitating human art; neither the petrifications of the Iriſh lake, nor the cauſeway, (*a*) which for its ſtupendous fabric, is thought the work of giants, would have any wonder in them: But they being extremely different from productions in the common courſe of nature, have drawn many perſons from diſtant parts to view them, have excited ſome to deſcription, and ſome to philoſophy.

What

(*a*) The Giants Cauſeway in the County of Antrim, is ſo well known a phænomenon, that to ſuppoſe the reader ignorant of it, would not be a compliment. See p. 2. Math. Lect.

What eſteem this preſent attempt to philoſophize after thoſe of ingenious men, who have already tryed, may deſerve, muſt depend upon what ſhall hereafter be delivered, and your judgment upon it. Nothing ſhall be ſaid with deſign to confirm or contradict, any former hypotheſis of any other perſon; nor ſhall your time be taken up with arguments, to invalidate the opinions of former writers upon theſe matters; meaning that what ſhall be delivered here, ſhall at leaſt give the pleaſure of novelty without contentious diſpute.

All the circumſtances of the phænomena, which make the ſubject of theſe lectures, and were very lately diſcovered, ſhall be fairly laid before you, together with ſuch reaſoning upon them, as ſeem conſiſtent with true philoſophy, that is, with the courſe of nature.

It may be proper to acquaint you in reſpect to the petrifications, which ſhall firſt be treated of, that all thoſe who have philoſophized upon that ſubject, have reaſoned without ever having been able to procure the ſight of any one ſpecimen of wood or ſtone continuous, except one gentleman *(d)* who having received abundance of ſpecimens and alſo remarks from the preſent Inquirer, was enabled to ſend preſents of the petrifications abroad, to make ſome experiments upon them at home, and to draw up a ſhort treatiſe, which makes the laſt paper upon this ſubject, in the tranſactions of the Royal Society; in which paper there is mention made of the preſent Inquirer, and a ſort of promiſe for the execution of what is now doing *(e)*. It is hoped nothing will be found herein, that will in any degree throw diſcredit upon that gentleman's performance; he had only an imperfect account of things, and never had an ocular view of the places of production of the petrifications. For moſt of the phænomena hereafter mentioned, were diſcovered ſince the publication of that paper.

There being therefore no account of theſe phænomena hitherto given to the world, upon real obſervations of the facts, in many important circumſtances, be pleaſed to accept of the beſt, which the preſent Inquirer with great ſubmiſſion to your judgments, attempts to give after much labour,

(d) This gentleman is ſpoken of in the laſt lecture as having excellent abilities and inclination for natural inquiries.

(e) See Addreſs page 15.

labour, expence and extraordinary ſucceſs in his ſearches. This account will conſiſt of anſwers to the following QUERIES.

Whether there be any ſpecimen of wood and ſtone continuous, ſo clear and diſtinct, that there can be no room to doubt of the nature of either?

If there be ſuch, what qualities have they?

Where are they found?

To what cauſe is the production of them to be aſſigned?

Is that cauſe peculiar to the water of the lake?

What kind of wood admits of petrification?

In what time is the petrification effected?

And in what place?

The firſt queſtion admits of a direct anſwer, that there are great variety of ſpecimens of wood and ſtone continuous, ſo clear and diſtinct, that there can be no room to doubt of the nature of either: That they are not incruſtations, but tranſmutations, and incorporations of one into the other *(e)*: For you ſee the table covered with them; and as you have full liberty of handling, and breaking, and cutting, and chewing, and burning them, you have alſo full information that one part of each maſs is a firm compact weighty ſtone, the other is a fibrous combuſtible wood. Of this kind indiſputable ſpecimens are laid before you, from 700lb. weight to one ounce.

The

(*e*) When the fluids of the human body can become bone, and in ſome caſes become ſtone, and the bones of the human body become ſoft as wax, as has happened to ſome perſons even in a living ſtate; and can eaſily be reduced to a gelly in Papins digeſter, when a petrified cruſt grows ſometimes on the teeth which muſt be filed off: Who ſhould wonder at the concretions of matter here treated of. For the truth of the fact of the human body turning almoſt totally into bone; the oſſified man in Doctor Barry's cuſtody is a proof: (See a ſhort account of this in the Natural and Civil hiſtory of the county of Corke, and ſomething alſo forward in this lecture; and for the truth of the aſſertion that the ſolids of the human body, may become ſoft and liquifie, the reader is referred to *Spond*'s travels, who gives a memorable account to this purpoſe.

Notwithſtanding all this, the world is not diſpoſed to believe the leſs ſurprizing phænomena of wood becoming ſtone: As may appear from the laſt book, publiſhed in Paris upon the ſubject of Natural Philoſophy, which are come to us with a high reputation.

On parle d'un lac en iſlande qui pétrifie, le lac Néagh en Irlande a auſſii la mẽme propriété mais ces pétrifications produites par l'eau des lacs, ne ſont, ſans doute autre choſe que des incruſtations comme celles que fait l' eau d' Arcueil. Hiſtoire Naturelle, &c.

Par. M. De Buffoon, A. Paris 1749.

The qualities of theſe mixt bodies are well worth your notice. The woody part, you ſee, is extremely hard and brittle, and light, of a brown colour very near reſembling that of yew, which is ſometimes found under ſtrata of turf, which is uſually cut for fire; it admits a plain and takes a good poliſh; apply a ſmall piece of it to that candle, you ſee it blaze and emit a fume; remove it, till the flame be extinguiſht, it continues red hot for ſome time, and falls into very light aſhes, having during the operation affected us with a ſmell, which by many is thought very fragrant and agreeable. This ſmell is excited by it in ſome degree, even without burning; and upon breaking of the ſtones, from which the wood has been ſeparated, the ſame ſmell will ariſe but in a fainter degree. It is hoped you will take particular notice of this, becauſe a reference ſhall be made to it, in the courſe of what ſhall be ſaid hereafter. All this kind of wood is not exactly of the ſame degree of brittleneſs or toughneſs; ſome of it has been found of that degree of toughneſs, which ſome kinds of wood have, which are uſed in human tools. But the application of this to ſuch uſes, would not be eaſy; becauſe the largeſt portions of it hitherto found, did not exceed thoſe blocks, which are at preſent before you; which being irregular in their ſhape, may be beſt denoted by their weight. One of thoſe blocks which is entirely wood, is 30lb. *(d)* weight; the other although weighing 50lb. principally upon account of the ſtony part, may not have ſo much wood, and the reſt have ſtill leſs. Yet ſeveral tons weight of it have been raiſed, but commonly in ſuch broken lumps and thin flakes, that they are only fit to make fuel for fire: For which uſe they are excellent, being in duration equal to pit coal, and in pleaſantneſs of burning preferable; becauſe they excite a fragrant ſmell. This fuel is almoſt fit for uſe the moment it is thrown up from its bed, at moſt it requires only one dry day to render it ſo. The reaſon of which is, that although it lies in a wet bed, yet it may be obſerved, that the inner part of the wood is often dry; or appears ſo, even in that bed; as well as the ſtony part, which may immediately upon being taken up, be comminuted into a dry powder, as well as ſplit like timber, by means of thoſe hammers, which, you ſee, are made in the forms of wedges.

This

(*d*) See Number XL. Lect. 3.

This ſplitting quality of theſe ſtones is univerſal, unleſs the knottineſs of the timber, of which they are formed, occaſions ſometimes an exception: But the aptitude to cleave is not alike in all; you ſee two blocks there which were once continuous, weighing 106lb. that took at leaſt forty ſtrokes of a 16lb. ſledge before it ſplit; (f) others ſplit with the fourth part of the labour. In that ſpecimen it is worth while to obſerve, that the wood ſeems interwoven with the ſtone, in the very heart of it, lying on the outſide in large flakes capable of being chopt with an ax. If an attempt be made to break theſe ſtones tranſverſly, it will be found extremely difficult, as it would be to cleave wood croſs the fibres. It is preſumed you will not take amiſs the tranſcribing of a paſſage from Dr. Hook, relative to the purpoſe, but never yet applied to it.

" Having taken, ſays he, the beſt piece of lignum foſſile that Doctor " ENT the donor had ever ſeen, I found it to burn in the open air, al- " moſt like other wood, and inſtead of a reſinous ſmoak it yielded a " very bituminous one, ſmelling much of that kind of ſcent. Cutting a " ſmall piece and charing it in a crucible with ſand, I found it infinitely " abound with a ſmaller ſort of pores, only obſervable in wood, ſo re- " gularly perforating it long ways, and ſo thick, that breaking it acroſs " I found it like an honey comb. As to the bigger ſort of pores alſo " obſervable in wood, I could not find that it had any. So that what- " ever was the cauſe of its production, it was not without thoſe ſmall " pores which we have only hitherto found in vegetables; and com- " paring them with the pores of charcoal, made with ſeveral other " kinds of wood, I find it reſembles none of thoſe, ſo much as fir, " to which it is not unlike in grain alſo, and ſeveral other properties.

" This wood is got in Italy, in the province of Umbria, now the " Dutchy of Spoletto, in the the territory of Todi, anciently called " Tudor; and between the two villages of Colleſeco and Roſaro, not " far from the high way leading to Rome, found there in greater quan- " tity than elſewhere.

This lignum foſſile appears, by what the Doctor ſays afterwards, to be a kind of ſtone in the ſeeming form of wood; for he proceeds thus.

(f) Number IV, Lect. 3.

" Whatever is by ſome, who have written of it, particularly by " Franciſco Stelluto, who wrote a treatiſe in Italian, which was printed " at Rome in 1637 affirmed, that it is a kind of clay or earth, which " in tract of time is turned into wood, I rather ſuſpect the quite con- " trary, that it was at firſt certain great trees of fir or pine, which by " ſome earthquake, or other caſualty, came to be buried under the earth, " and was there after a long time's reſidence (according to the ſeveral " natures of the incompaſſing adjacent parts) either rotten or turned in- " to clay, or petrified and turned into a kind of ſtone; or elſe had its " pores filled with certain mineral juices, which being ſtayed in them, " and in tract of time coagulated, appeared upon cleaving like ſmall " metalline wires; or elſe from ſome flames, or ſcorching forms, that " are the occaſion oftentimes, and uſually accompany earthquakes, might " be blaſted and turned into coal; or elſe from certain ſubterraneous " fires, which are affirmed by that author to abound much about thoſe " parts, are by reaſon of their being incompaſſed with earth, and ſo being " cloſe from the diſſolving air, char'd and converted into coal (s).

Thus

(s) About a year paſt the Author employed a gentleman, juſt returned from his travels, and whoſe acquaintance in Italy was freſh in memory, to write to a curious perſon there, to ſend an account of this *lignum foſſile*, and alſo a ſpecimen; but no anſwer has been as yet returned.

What Doctor Hook ſays elſewhere, may be related here alſo.

Thus often have been, and are ſtill daily found in other parts of the earth, buried below the preſent ſurface thereof, divers ſorts of bodies, reſembling both in ſhape, ſubſtance and other properties the parts of vegetables, having the perfect rind, or bark, pith, pores, roots, branches, gums and other conſtituent parts of wood, though in another poſture, lying for the moſt part horizontal, and ſometimes inverted, and much differing from that of the like vegetables when growing, and wanting alſo for the moſt part, the leaves, ſmaller roots and branches, the flower and fruit, and like ſmaller parts, which are common to trees of that kind, of which ſort the lignum foſſile which is found in divers parts of England, Scotland, Ireland, and divers parts of Italy, Germany, the Low-Countries, and indeed almoſt in every country in the world. Hook's poſthumous works, fol. p. 288.

The wood and petrifications which are part of the ſubject matter of theſe Lectures, are not included in Doctor Hook's remark, tho' he mentions Ireland. And p. 297. the ſame writer ſays,

One inſtance I cannot omit, as being the moſt obſervable of any I have yet heard of, and that is, Dr. Caſtle's relation of a certain place at Alpsby in Bedfordſhire, where there is a corner of a certain field, that doth perfectly turn wood, and divers other ſubſtances in a very

Thus from the Doctor's manner of accounting for this phænomenon, it appears, that this *lignum foſſile* might, in different ways of conſidering it, either be called wood or ſtone: and in this to be ſimilar to ſeveral ſtones found about our Lake, ſome of which lie before you, and pretty nearly anſwer this deſcription, and were the uſual ſpecimens heretofore produced, and of which it is common to make whet-ſtones.

You ſee how eaſily they cleave in the form of wood, what evident marks and veſtigia of wood appear in them: The fragrant ſmell alſo upon burning is another circumſtance, common to the petrifications of Lough Neagh, and the lignum foſſile of Italy. Whether the ſmells be xactly the ſame, can not eaſily be ſaid, without an immediate compariſon; but in as much as the Doctor ſays, the ſmell of the lignum foſſile is not reſinous; no more is the ſmell of theſe, yet it is a ſtrong ſmell, when the wood is burning in a large quantity; and a faint ſmell of the ſame kind, when only ſtone is burning; and perhaps this is the ſcent of

very ſhort time into ſtone as hard as flint and agat. A piece of this kind I ſaw affirmed to have been there buried, which the perſon that had buried it, had ſhot ſmall ſhots of lead into; the whole ſubſtance of the wood, bark and pith, together with the leaden ſhot itſelf, was perfectly turned into a ſtone, as hard as any agat, and yet retained its perfect ſhape and form; and the lead remained round, and in its place, but much harder than any iron.

To this account may be annext, a paſſage from Kircher, in his Mundus Subterraneus, lib. 8. Sect. 2. Cap. 6.

Aquâ ſpartâ 50 milliarium intercapedine Roma diſſitâ vidimus certum quoddam terræ genus, rude admodum, et veluti quibuſdam arborum corticibus oppido exaſperatum, quibus remotis, in terræ duriuſculæ et neſcio quo lævore ſplendoris venam incidimus: Atque hanc aiebat, eſſe terram, ex qua Romæ conficerentur pretioſæ tabulæ.

Nullum hic arboris aut rami petrefacti veſtigium ſed terra prorſus videbatur; quæ intra terram nonnihil mollior, aeri tamen expoſita prorſus in ligneam ſubſtantiam indureſcit; ita ut non ſecus ac aliud quodlibet lignum facile dolari polirique ebeni ad inſtar poſſit——Natitare neſciunt———Flammam non concipiunt——Verbo, neque terra eſt, neque ſaxum, neque arbor——itaque olim haſce fuiſſe arbores, videtur cujus ſigna pervetuſti cortices ſat ſuperque demonſtrant in fodinâ ubique paſſim obvii, non tamen ſucco aliquo lapidifico in petram induratas, ſed ſucco aliquo peracri et mollificante in minutiſſimas partes diſſolutas, quibus terreſtre lutum, cujuſcunque id tandem generis fuerit intermiſtum ac interfluum particulas minimas arborum diſſolutarum in unam maſſam terreno-ligneam contraxerit, ita ut nec purum lignum, neque pura terra neque ſaxeum quid dicit poſſit.

No other remark ſhall be made upon this extraordinary account, which Kircher gives, but that the phænomena treated in theſe Lectures, are extremely different from the matter he deſcribes, which is neither terra, nor ſaxum, nor arbor. For the ſpecimens of theſe phænomena, ſome wood, ſome ſtone transformed from wood, ſome partly wood indiſputably, and ſtone indiſputably in different parts of one continued maſs, ſome an intermixture of the two kinds of matter, as it were, ingeniouſly woven together.

bitumen *(t)* which he means. This ſmell is generally thought pleaſant when it is in a ſmall degree.

There are therefore before you two kinds of ſtone, both of the claſs of petrifications.

I. Thoſe which appear to the eye to be now wood, although they are really ſtone; and are generally white in colour, porous and comparatively lighter than other ſtones, cleaving eaſily lengthways, grinding to a ſmooth ſurface, ſo as to be fit to whet knives, and never yet found with any wood continuous to them, and commonly found in ſmall pieces.

II. Thoſe which are large, harder, and more weighty, black internally and externally, found lately in many inſtances with much wood upon the ſurface, and alſo with a good deal of wood intermixt with the inward parts of the ſtone.

The properties of both theſe kinds are. They cleave like wood, they contain abundance of fire, as may be proved by uſing them as flints, and rubbing one upon another, even when they are wet; and they bear the fire ſurprizingly: For although they are eaſily made red hot, yet they neither burn to lime nor vitrify. And it muſt not be omitted to tell you, that thoſe of the heavy black kind, when burnt in the fire, become white and light, and cleave eaſily, being made thereby like thoſe of the firſt kind, and alſo capable of imbibing a great deal of water; for the internal wood being conſumed, leaves many cavities for the water *(u)*.

Beſides theſe two kinds, it may be proper to point out a third ſpecies of mixt matter, which is ſometimes found in the private chambers of theſe ſtones, to wit, ſhining ſpangles of a ſparry ſubſtance, ſo intermixt with wood, as to appear to the eye through a magnifyer, like beautiful rocks of cryſtal: And ſome of this matter collected into cluſters of cryſtals, have ſuch beauty to the naked eye, as to be thought by ſome to deſerve being ſet in gold. A beautiful ſpecimen of this kind, with a ſmall

(t) The Inquirer is not ſo well acquainted with the properties of bitumen, as to judge accurately in this caſe, but Boerhave ſays, Chem. 31. London 1735. 'Petrolium is expreſſed 'from melted bitumen; drops down the rocks, is exceeding thin, very light; of a fœtid 'ſmell, and perfectly inflammable &c.' This liquid is often called bitumen, tho' they differ in colour, ſmell and tranſparency. The ſmell therefore of bitumen may be the ſmell which here is called a fragrant ſmell; ſince a bituminous ſmell is different from the fœtid ſmell of Petroleum.

(u) See Number CLI. Lect. III.

ſmall piece of ſound wood paſſing in a ſtraight line through the cluſter of cryſtals, was preſented lately to a gentleman in Dublin, who is ſedulous in all ſorts of inquiries into nature.

Two of the queſtions being thus fully anſwered, the next queſtion is, where are theſe ſpecimens found?

In order to anſwer this fully to your ſatisfaction, it is neceſſary to lay before you a map of the lake, in which it is not requiſite to give the ſtrict dimenſions, but only ſuch from common repute, that any future inquirer may certainly find the places, as any traveller may find a great road through a country, from the honeſt information of one who went before him. See Grierſon's Map, Plate 5. Lect. 4.

From (a) which is the boundary of the County of Ardmagh, to (b) the mouth of the river Ban, being 2½ hours riding, there are variety of ſhores, ſand, ſtone and bog. From b to c being half an hour * partly ſtony, partly ſandy. From (c) the black water and the boundary of the County of Tir-Oen, to (d) the boundary of the County of London-Derry, being three hours, the ſhore is ſand, ſtone and bog. From (d) called the river of Balinderry or Coah, to (e) the river Moyola being one hour, the ſhore is for the moſt part gravel and iron ore. From (e) the Moyola, to (f) Toom, the boundary of the County of Antrim, and the common diſcharge of the lake called the lower Ban, being half an hour, is partly ſandy, partly a plaſhy wet ſhore; from a mixture of ſand, clay, and the water of the river Moyola and lake. For here they mix. From Toom to (g) the river Main three hours, half gravel, and half extremely rough, and impoſſible to be rid cloſe to the water. From (g) to (h) the river of Antrim one hour, partly incloſed in a deer-park, and not examined, partly a very fine ſtrand; from (h) the river of Antrim to (i) Camlin or Crumlin river, two hours, moſt part good riding, yet many looſe ſtones are ſcattered upon the ſhore, and the banks much worn with water; from (i) to (k) the river of Glenevy, being half an hour, all ſand. From (k) to (l) Portmore park two hours, being a rough ſhore admitting one ſhort ſpace of ſand; from (l) to (a) which includes a ſmall ſpace of the County Down, which juſt touches the Lake; together with

* If the diſtances denoted by the time of riding, do not ſeem to agree with the map; it ſhould be remarked that this and every other map of Lough Neagh, are exceedingly inaccurate, and that the Author of theſe Lectures did mean to give the public an accurate map of the Lake, but could not do it without an encouragement greatly exceeding the preſent meaſure of generoſity.

with the remainder of the County of Antrim, being two hours, the ſhore is in ſome places rough ſtones, in others bog covered with ſand.

The Lake has two iſlands with ſtone buildings in them: For the ſmall Lake, called Lough Beg, north of Toom, as commonly reckoned part of Lough Neagh, is not in the ſurvey. That Lough has an iſland in it, and the ruins of a church; that iſland was once part of the main land. One of the iſlands of the great lake is a league from the ſhore, the other, one third part of a league, and are evident proofs of the incroachments of this lake upon the main land: For theſe houſes were certainly built when the grounds they ſtand upon, were contiguous to the main land.

This great body of water covering about an hundred thouſand acres, and formed by the influx of eight rivers beſides ſmall rivulets, may be determined to be of modern date; by modern being meant, any time later than the general formation of ſeas and lakes, when this globe underwent a conſiderable alteration at the general deluge. For it is perhaps the ſhalloweſt lake in the world, of its dimenſions, being according to the account of navigators upon it, not more than eleven fathom in the deepeſt place. Whereas the lake of Geneva has been tried with four hundred fathom of line, without proof of the bottom being reacht: Surely in a courſe of ſome thouſand years, floods might have worked deeper than eleven fathom, which does not exceed the height of an ordinary church ſteeple.

Beſides the evident proofs of its incroachments juſt mentioned: (*d*) The diſcharge at Toom being very liable to be choaked with ſand is always

(*d*) In a pamphlet publiſhed in the year 1738, concerning the lowering the water of this lough, there is the following remark which is to the preſent purpoſe.

I have not mentioned the rapid river Claude near Portglenone, becauſe it falls not immediately into the lough itſelf, but enters the lower Ban near Portglenone, and there being obſtructed in its courſe towards the ſea, by the very deep water near Portna, it is driven backward in time of floods. Beſides as the courſe of the lower Ban runs towards the north, and the north wind that blows againſt them is often ſtrong, and in the time of poor Richard the ſecond, when he was in Ireland was ſo long northerly, that he had not a poſt from England in ſix weeks after that the Duke of Lancaſter was landed, and his ſubjects in arms againſt him, this northerly courſe of the wind blows the water backward in ſo ſtrong a current that if any one throws either a ſtick or any light thing upon the water, they will ſee it ſwim upwards againſt the courſe of the river, till it be out of ſight. I will aſk now what becomes of this vaſt quanlity of water which comes into the lough and is ſtaid there, and perhaps

always occaſioning a delay in the flux of its water, which raiſes and extends its ſurface. And the violence of the waves tears and rends the banks, whether of turf or clay: But the former of theſe ſeems to have been the kind of matter which at firſt made the common baſin of all the rivers. For there are very good reaſons to incline any one to think, who conſiders it attentively, that the great bogs in the County of Tir-Oen marked (*q*), and thoſe of the County of Ardmagh marked (*s*), and that of the County of Antrim marked (*v*), were all once one continued bog, with ſome iſlands of firm land, and perhaps ſmall ſtagnant interſperſed lakes. For of this kind the great bog (*s*) is at preſent; having raiſed tracts of arable land in it called iſlands † containing thirty, forty, fifty, and ſixty acres, and ſmall lakes of one acre of water and more, to the ſize of one which is four miles round, called Lough Gullian.

Seeing that it is generally and not unreaſonably ſuppoſed, that all bogs of turf have ſprings under them *, it ſhould ſeem likely, that this lake ſhould abound with ſprings: But on the ſhores and neighbouring Lands, although diligent inquiry was made concerning them, very few were found, and hardly any that kept their fluid ſtate during the hard froſt, in the year 1740, except one ſmall ſpring marked (*x*), and another of chalybeate water, marked (*y*). There is a remarkable well marked (*z*), called cranfield, and mentioned in the Philoſophic Tranſactions under the name of Cranbourn, with a ſuperſtitious account of brown cryſtals, growing there in a night's time, and that only on May

perhaps never runs out. Without anſwering matters of fact with philoſophical conjectures, it hath made the lough itſelf riſe and ſpread, and fill itſelf with ſand-banks, till it hath ſpoiled its own navigation, and not only incompaſſed one church, that of Ballyſcullin, and drowned a great part of the pariſh, but has covered great tracts of other rich land, that once adorned it with thoſe noble oaks and firs that we now fiſh out of it.

One fiſherman that had removed his houſe twice, and was forced to move it again, complained, that he knew not where he might ſet it, for the Ban followed him. See an anſwer Lect 6.

† They are called Derry with ſome additional word in compoſition. Derry in Iriſh perhaps from δρυς an oak, ſignifying a planted piece of ground incompaſſed with a bog. Innis in Iriſh ſignifies a piece of ground incompaſſed with water. London-Derry, Innis-ſkillen.

* Although the top of a mountain called the DEVIL'S BIT, in the County of Tipperary, be a ſolid rock to a conſiderable depth of pebbles cemented, yet it has a tegument of excellent turf about two feet thick, without any appearance of poſſibility, of being produced by ſprings, but with a fair probability of being produced by the roots of heath conſtantly growing there.

May eve: Large ſpecimens of theſe cryſtals much reſembling brown ſugar candied lie before you; they were found two miles from the ſpring, growing plentifully in the clefts of a rotten rock, and alſo in the ſod which grew over it, from which it ſeemeth probable their growth was pretty quick: For the ſod appeared to be a late collection of dirt and graſs. Diligent inquiry was alſo made concerning ſprings under the water of the lake; one perſon of no great veracity, aſſerted, there were places unfrozen in the winter 1739-40.

Theſe cryſtals Mr. Boyle takes notice of in his treatiſe of Gems; where he ſays, 'there is a lake in the north of Ireland, which ſupports 'fiſh as well as other lakes, when nevertheleſs in the bottom of it are 'rocks, to which adhere maſſes of beautiful figured ſubſtances in clear-'neſs and tranſparency imitating cryſtal; a preſent of which the chief 'proprietor of the lake had ſent him with a promiſe of more.

Concerning theſe cryſtals, more ſhall be ſaid hereafter.

But it is time now to anſwer the queſtions concerning the places where the ſpecimens of petrification have been found.

Having given a deſcription of the lake, together with the diſtances computed according the common rates of travelling, be pleaſed to caſt your eyes upon that point which lies on the ſouth eaſtern ſide, under the title of Ardmore point, cloſe upon the great bay called Tradubach: There was the firſt ſpecimen found of indiſputable petrification, weighing about twenty eight pound, partly expoſed to the air, and partly in clay, within ten yards of the water of the lake, and which had been a ſhort time before covered therewith. Its ſituation was ſuch as to render it eaſy to ſuppoſe that it had been rolled thither by the winter ſtorms. For large maſſes of other matter heavier than water, are frequently ſeen upon ſhores of the lake to which they did not belong, their native beds being ſome miles diſtant, particularly lumps of turf bog, ſome ton weight. For water deducting from all bodies that lie in it, and are ſpecifically heavier than a weight equal to that of as much water, as the ſurface of the body could contain, (that is, by ballancing ſo much of the weight it is equal to a deduction of ſo much, ſo long as the bodies continues in the water) the overplus weight by which the body ſinks, is but a ſmall reſiſtance to the violence of waves, which may roll them hither and thither.

The

The ſhore of Ardmore point is rough, abounding with round ſtones, which render it unpleaſant, but not impoſſible to be rid. 'Tis nearly of the ſame kind for two miles northward; but as far to the ſouth is altogether a bed of turf or pete, covered unequally with the ſand of the lake, where the water having eaſily waſhed away, the ſoft yielding ſubſtance of the turf throws up a deceivable covering of ſand.

Although diligent ſearch was made along this ſhore for ſpecimens, and many little fragments were found, yet none with wood continuous, except this one, till two years afterwards; when three large ſtones of the ſame kind, were found in the water near the ſituation of the firſt *.

Whereas former Inquirers have left upon record, that the mouth of the black water and neighbouring ſhores, were particularly remarkable for productions of theſe petrifications, it was proper to examine thoſe places accurately; which was done, yet nothing curious found. And to come directly to the purpoſe, the entire encompaſſing ſhore of the lake was carefully ſearched without ſucceſs, from the former point, to a point called Ahaneſs, in the County of Antrim.

This place ſeeming to be the forge, where theſe materials receive part of their form, deſerves a particular and accurate deſcription: Becauſe future reaſoning concerning theſe productions, muſt in a great meaſure depend upon it.

Ahaneſs is half a mile ſouth of the mouth of the river Glenevy, and the ſhore between them is ſandy, it is three miles north of Portmore

* The letter of a very worthy Clergyman, who employs his time uſefully in religion and and huſbandry, is to this purpoſe; who at the requeſt of the Inquirer, dug a pit in a part of the ſhore which was not examined accurately before.

October 9, 1749.

A pit was digged five yards from the water of Lough Neagh on Tradubach bay, in the pariſh of Sego, and County of Ardmagh, nineteen feet long, nine feet broad, and nine feet deep.

At 11 inches from the ſurface, a piece of petrified wood was found in red crumbly clay, ſome ſmall pieces of black wood, ſome common ſtones, ſome lime ſtones.

At 22 inches from the ſurface, more black wood than before, clay, part red, part black, crumbly and hard to dig.

At 33 inches, a greater quantity of black wood, and larger than before, black mouldy clay. Erom 3 feet down to 8 feet, a few ſmall pieces of black wood, very few common ſtones, black clay as before, at the depth of 8 feet from the ſurface, the largeſt piece of wood was found; 9th foot, the ſame ſort of black clay, quite dry, not the leaſt appearance of water throughout. J. CARROL. *Compare this laſt remark with page* 98.

park, markt (l) †; and the ſhore between them is for the moſt part rough, except in one place for five hundred paces it is ſandy and pretty deep: The part immediately adjoining upon Ahaneſs, is a ſurface of yellow clay covered roughly with ſtones. The bank over the ſhore from Portmore to Glenevy river is high, from ſeven to twelve feet in different places, and is a ſtiff red clay; the appearance of it being perpendicular in ſome places, without any plants growing upon it, denotes the violence of the water of the lake in winter floods and ſtorms; which have waſhed away all the ſurface of the earth, between it and Ram's iſland (o), which lies about one league from the ſhore; but was certainly once part of the main land.

At Ahaneſs there has been raiſed from time to time, above two ton weight of ſtones, with wood continuous to them, one of which weighing 150lb. is depoſited in Trinity College, near Dublin (p); and ſeveral ſmall fragments of extraordinary rarity, got by breaking the large ſtones, are depoſited in the Univerſity of Cambridge, with the Woodwardian profeſſor of the knowledge of foſſils (q). A collection of the ſame kind and value, is alſo preſented to the learned Dr. Richard Mead, and may be ſeen among his rich and judicious collection of rarities: The receipt of theſe was acknowledged in a very handſom manner, by letters from the Uuniverſity and Doctor Mead (r).

Theſe ſpecimens, with what lie before you, ſhall be vouchers, not only for the fact of petrification, but alſo for a good deal of that reaſoning, which ſhall hereafter be uſed; in order to make which as concluſive as poſſible, every circumſtance of the place, wherein theſe heterogene wood-ſtones are found, muſt be minutely related.

The bank at Ahaneſs is twelve feet high, between the bottom of which, and the loweſt water mark in ſummer, there is a ſpace of about ninety feet, which ſpace in winter is ſometimes covered with water. Upon digging a pit in this place (of which there are ſeveral made) The

† Grierſon's map. (o) Otherwiſe called Innis Garden.

(p) This ſpecimen and petrification firſt found, were preſented to the Univerſity near Dublin, the firſt found ſpecimen was fixt in a frame of holly: There was alſo preſented at the ſame time, a very curious ſmall ſpecimen, which the Rev. R. Diſney, T. D. in the receipt which he gave for the whole as Librarian (there being ſome books alſo preſented at the ſame time) promiſed to have framed and glazed for preſervation.

(q) See the letter from the Univerſity of Cambridge, in the addreſs prefixt to this book.

(r) See letter from the Univerſity and Doctor Richard Mead, in the Addreſs

The upper ſtratum of matter is red clay, three feet deep, the ſecond ſtratum is ſtiff blue clay, four feet deep, the third ſtratum is a black wood, lying in flakes four feet deep; the next ſtratum is clay. From the top of the ſtratum of wood to the ſurface of the earth is ſeven feet, and before the water of the lake incroached ſo far upon the land, it was nineteen feet, which is neceſſary to be remarked, in order to account for the form in which this wood lies. For it has no intermixture of the neighbouring ſtrata with it, nor has it any void ſpaces as ſhould be found amongſt timber thrown in a heap, unleſs ſome incumbent weight ſhould ſo preſs the maſs, as to reduce the round form of trees to a flat, and thereby fit them ſo exactly together, that they may appear one ſolid uniform maſs; or ſo preſs the ſmall boughs with their leaves into the interſtices, as to give the appearance of one ſolid homogene maſs. In many places of this maſs, the leaves of trees ſeem principally to be preſſed together, ſo as to form matter of the viſible appearance of what the workers in leather call JUMP, being thin parings ſo united by preſſure, as to become ſufficiently firm for heels of ſhoes.

For the wonderful effects of conſtant preſſure (tho' the preſſure be not great) ſhall be demonſtrated in the next lecture.

Such a kind of appearance this ſtratum of wood has; it is one uniform maſs capable of being cut any way with a ſpade *, tho' more eaſily with the grain, and breaking thereby into ſmall flakes, may be thrown up to be fuel for fire: It has evident marks of violent colliſion or preſſure, as may be ſeen in the ſpecimen before you; where the fibres of ſome are ſqueezed up into a complicated cluſter, as if a man ſhould ſqueeze end ways in a vice, a ſhort piece of hempen rope; or laying a longer piece upon two planes almoſt contiguous, ſhould by a preſſure from above, ſuddenly bend the fibres and force them out of their uſual direction, a little way into the aperture below, and perhaps tear ſome of the fibres; *(e)* which remark will appear to be of ſingular uſe hereafter. The flaky parts, upon cloſe examination, ſeem to contain in them ſmall boughs, and are themſelves principally made up of leaves very cloſely preſt together. Sometimes this wood will not eaſily break, and in that caſe, requires the aid of ſome other tool to ſeparate it from the maſs, which, if carefully done, may afford a block of two, three or four hun-

(e) See Number XXVII. Lect. III. * Foſſil wood is often ſoft in the earth, and grows hard and tough in the air.

dred pound; which when examined, are found to conſiſt more or leſs of ſtone: One of them at preſent in your view, is about two hundred and fifty pound weight.

Here and there is found ſmall congeries of white clammy matter, much of the appearance and conſiſtence of thick cream, or liquid and grumous chalk, not gritty, taſtleſs and eaſily diſſolving in the mouth after chewing; perhaps it may not be improper to call it *lac-lunæ*. For when it is dried, it becomes a white ſubſtance, with a ſmall degree of coheſion, like very brittle chalk.

It is not eaſy to examine the wood in theſe pits, ſo as to judge of the groſſneſs of the timber which makes this ſtratum: Becauſe they are ſo compreſſed together, that no diſtinction can be made. The appearance ſhould at firſt incline one to think, that they were an heap of chips with a few blocks of groſs wood thrown in amongſt them. The influx of water at the time of working, is another difficulty in this inquiry. Nor is it eaſy to determine whether this water be a real ſpring, or the water of the lake which is ſome feet higher than this ſtratum, and not many feet from it. For although the ſtratum of clay immediately above the wood, is ſeemingly tough enough to reſiſt all penetration of water (as the working peaſants well know, who preſs it with their feet into holes, when the water flows upon them in a ſtream, and thereby ſtop it for ſome time,) yet if this bed of clay has any open paſſage any where in the neighbouring lake, the water may eaſily flow in, and afterwards inſinuate itſelf through the layers of wood: For although the inner part of a large hard log ſeems immediately dry, when taken out of its bed, yet the ſurface is always wet. It is probable that this water is no other than the water of the lake; becauſe, were it that of a ſpring, perhaps ſomewhere on the ſhore in the neighbourhood, it would burſt out and ſhew itſelf, but no fountain is obſerved to be in the neighbourhood.

It muſt not be concealed that this ſtratum of wood, does not ſeem to keep an exact paralleliſm with the horizon, but towards the land ſeems to riſe higher, in ſo much that at the bottom of the bank, at an height to which the water of the lake never reached, this ligneous ſtratum was obſerved, and in it a petrification of ſome pound weight, which ſhould have been taken, if there was not danger of bringing down twelve feet height of clay upon the workman's head.

The

The qualities of this wood as to burning, cleaving, and bituminous ſmell, have been already taken notice of, and need not be repeated (*f*).

And as to the extent of this ſtratum of wood, you may as well judge of it from the map as from the land: For it is certain, that it is continued under the clay bank into the land, and under the water of the lake the contrary way; how far it extends along the ſhore, may be tried by others, to whom the expence of digging will not be burdenſom: Experiments hitherto made, do not take in more than a hundred feet. But that it extends under the lake a conſiderable diſtance, or that there are ſtrata of the ſame kind of matter, a conſiderable diſtance from this place, under the water of the lake is plain, from the finding of ſpecimens at twelve miles diſtance from it. For the promontories, which project out into the lake, called by the neighbouring inhabitants points, would in all probablity interrupt the rolling motion of any ſtones from Ahaneſs pit, to places on the ſame ſide of the lake. Therefore the ſpecimen found firſt at Ardmore point, was the property of ſome other pit, which perhaps lies out in the body of the lake; and the finding of three large ſpecimens afterwards, in the water near that place, is a good proof of this. For the Rev. Mr. CARROL, a very worthy Clergyman mentioned*, who lives near Ardmore point, and has a curious diſpoſition to ſearch into nature's works, conſiſtently with his clerical employment, which he has for many years attended with diligence; not only found ſome ſpecimens, in water, of petrifications with wood continuous, having ſearched at the requeſt of the Inquirer, along Tradubach bay; but alſo digging to the depth of nine feet, gave an account by letter, of his having met with ſome lumps of mixt matter of the ſame kind; but he did not arrive at any continued ſtratum of it in the manner deſcribed at Ahaneſs; perhaps he did not go deep enough, or perhaps the ſtratum lies under the water, where it is not eaſy to get information. That a ſtratum lies ſomewhere in the neighbourhood is probable. For one ſpecimen he found in the water, was two hundred weight; and being flat, could not have been rolled far. For if it had, the action of rolling would have altered its ſhape, at leaſt have worn off the wood: But it had a great deal of wood in the ſurface.

It

(*f*) See from Number C. to CLIII. Lect. III. Alſo page 86, 87. * See note page 95.

It is ſtill of more importance in determining this to obſerve, that the ſtratum of wood at Ahaneſs lies ſeven feet below the water, and could not have any part of it rolled into the lake, till the ſeven feet of clay was firſt waſhed away, but that ſtill remains as a barrier between it and the violence of the water. There are therefore ſtrata of this matter in the body of the lake, made bare of all ſuperincumbent ſtrata of denſe matter, and therefore liable to be diſturbed in ſtorms. Even at Ahaneſs if a fair experiment was made at a diſtance from the ſhore: Where the water is more than ſeven feet deep. There is little doubt but that many ſpecimens might be found. But to proceed in deſcribing other places, where ſpecimens have been found.

Obſerve Gentlemen in the map the river Camlin, about two miles diſtant from Ahaneſs: Upon this river about one mile from its mouth, was found the largeſt ſpecimen of theſe petrifications: It weighs 692lb. and being too weighty for a table and unmanageable, it is placed at the outſide of the houſe *(g)*. If the fragments broken from it, of which here is one, be added, its weight was more than 700lb. It is intirely ſtone without, and this fragment of it ſhews that it has a great deal of wood within. It was found under a bank ſix feet high, and almoſt buried in gravel raiſed three foot above the ſurface of the river, when the water was low: It appears like an old ſtump of a tree, and was found in the poſture of growth: Care was taken in raiſing it to obſerve nicely the bed in which it lay; but nothing ſingular could be ſeen: It had no roots extended from it, nor the appearance of any in the gravel decayed or petrified. This was not the place of its formation *(h)*; It ſeems to have been rolled thither by ſome violent flood from an higher part, of which violence the banks in many places give evident proofs: And the lake is no way concerned in the production of this ſpecimen of petrification, for it could not move againſt the natural courſe of the water. There is therefore ſome bed of petrification higher up in the river Camlin. Search was

(*g*) See Plate 3. fronting Lect. III. And deſcription, Number I. Lect. III. Alſo advertiſement Lect. III.

(*h*) This ſpecimen is very extraordinary, and perhaps the moſt curious of any in the world, one equal to which may perhaps never be found, even at the Lake which is ſo famous for them; and of which, a gentleman of letters, wealth and extenſive acquaintance in the world, ſaid, he knew places where it would be purchaſed at a hundred guineas. It is

was alſo made for ſome large ſtones of this kind, upon the river Glenevy, but the ſands having covered the places where reports ſay they lay, no diſcovery was made, and therefore all remarks may be ſpared.

Beſides

is at preſent kept in a large oaken frame, whereby it may be conveyed to any place without injury, and that foreigners unacquainted with the Engliſh language, might be acquainted with it, a ſhort deſcription of it was printed in the following form, and ſent abroad with a copper plate of it annext thereto.

In gratiam extraneorum,

SPECIMEN LIBRI

Qui inſcribitur

LECTIONES

In Philoſophiâ Naturali, quibus fundari poterit Ratiocinium, quod reſpiciet Petrificationes, Gemmas, Cryſtallos, et Qualitatem Sanativam Lacûs NEACHI in Hiberniâ.

QUandoquidem multa INQUIRENTI fortè fortunâ occurrebant, quæ antehac fruſtra quæſiverant alii, iique rerum * novarum avidi: SPECIMEN operis delineatur, ut ii, quibus cordi ſunt iſtius modi ſtudia, Propoſiti Fautores fiant.

Divitibus et Doctis, qui volunt et qui pollent, opus eſt Philoſopho in arcana Naturæ impenſè inquirenti; quorum gratiâ, præcipuè qui Linguam anglicanam parum, aut neutiquam callent, Deſcriptio molis Saxo-ligneæ, Ære, et Verbis, aliquo modo exhibetur. Præ Multis, quorum continebit Syllabum in lucem jam proditurus Liber, profertur inſigne illud Saxo-ligneum Specimen; ut pote quod apud poſteros duraturum ſtabilibit veritatem, aliis forſan, minoris pretii et ponderis, amiſſis aut perditis; adeo imitatur aurum, cujus pondus eſt valor.

ΛΑ ΑΣ 'ΑΝΑΙΔΗ'Σ, potiuſve MOLES SAXO-LIGNEA ad profunditatem quorundam digitorum inſigniter lapideſcit, ignisq; plus quam Scintillas chalybe percuſſa, quem valde conterit, emittens, lignum intus reconditum mollius quam pro more ligni habet. Fragmentum enim C. D. (duæ enim ſunt facies ejuſdem fragminis ſecundum modulum digitorum exaratæ) ex apice Molis, magnâ non ſine vi diffiſſum, ex ligno, lineâ *b c*. æque ac lapide alibi conſtans, argumentum eſt, lignum intus in corde Molis latere; cujus copiam, rimando vulnus *a* cultello, primi ſpectatum admiſſi acquirebant. ÆS ſignatum A (una facies Molis Saxo-ligneæ, cujus altera B) exprimit pondus, teſtimonio magiſtratûs, cujus erat in Emporio pendere res mercales. Color eſt albus aliquantulum flaveſcens, quoniam forſan in Sabulo, quo reperta eſt, diu jacuiſſet; cujus adhuc cernuntur calculi, per ſcabram ſuperficiei partem, cellulis, velut malleo ſixi. Materia vero ita colorata craſſitie hodiernum non excedit monetæ argenteæ Anglicanæ Denarium, reliqua nigreſcit, præter quod quibuſdam eſt cærulea locis. Atque ita ſe habet in aliis. Plurima enim petrificationis Specimina in ſuperficie

* Nevil, LLhuyd, Smith, Molyneux &c. vide acta Eruditorum Angliæ Philoſophica. Titulo Regalis Societatis.

terræ

Beſides theſe places, there are others too numerous to be mentioned particularly, wherein petrifications are found, that is, thoſe of the white light kind, which never were ſeen with any wood continuous. It is common to find them upon the ſhores, ſuch as are all ſtone and of the white kind, and the general remark upon them is, that they have the marks of an ax upon them.— But this laſt circumſtance is a good argument to prove, that they are no more than the heavy black ſtones carried from their native beds, and bleached by the ſun, after being well waſhed with water, ſo as to loſe all their wood. For the wood of Ahaneſs pit, is frequently obſerved to break croſs the fibres in ſo ſmooth a manner, ſometimes ſloping, ſometimes tranſverſly, as not improperly to repreſent the effect of edge tools.

The wood when petrefied, has often a ſurface ſimilar to theſe ſmooth tranſverſe ſections, but it is probable the wood was firſt broken into this form and petrefied after; becauſe it is not eaſy to break the ſtone croſs the fibres, into theſe ſmooth ſurfaces.

Theſe

terræ jacentia albo gaudent colore, a cretâ non multum abludente, pauca vero cæruleo, præſertim ſi aſpergantur pluviâ: intùs nigreſcunt: Si conterantur Specimina, pulvis fiunt ſuſcus, aliquando ſubalbidus, et inter conterendum, odorem excitant ſenſationi gratè balſamicum, et ſibimet ipſis forſan peculiarem.

Inventa eſt hæc Moles Saxo-Lignea, duo millia paſſuum a Lacu, juxta fluvium GAMLIN, ſupra vero aquæ ſuperficiem in ripâ tres circiter pedes: Supra hanc materia perpendicularis ſabuloſa, tanquam Ripa ſupra Ripam, vel agger quidem videtur; attamen eſt ſtratum materiæ antiquum, minimeque factitium, gramine, præter faciem ſex pedum verſus fluvium, haud tenuiter veſtitum. Facies Ripæ quaſi nuper aeri oculoque expoſita, nullâ gaudet herbarum ſpecie. Circa molem vero Saxo-ligneam, cujus pars aliqua prominebat in Ripâ inferiori veſtimentum erat tenue gramineum.

MOLES hæc, neque truncus neque radix arboris, utriuſque vero particeps, vegetationis habuit poſituram; prout marcidæ arborum partes locis præſertim ceſpititiis ſæpiſſimè cernuntur, radix ſcilicet ſubter terram, pars admodum ſcabra trunci in aere. Nulla autem erant veſtigia radicum ſeſe undique extendentium, pro more aliarum arborum, neque ulla indicia molem hanc, dum arbor fuit, ibi vitâ frui vegetabili. Nam proxima fluit aqua jugis, atque, etiamſi juxta creſcunt frutices in Ripâ ſabuloſâ, Arbor, magnitudinis, qualis hæc olim fuit, in materiâ inſtabili ſe neutiquam ſtabilire potuit.

Undè igitur, et quæ vis huc appulit MOLEM inſignem Saxo-ligneam? Cuinam debetur cauſæ immediatæ metamorphoſis illa miranda? Quantum eâ peragendâ inſumptum temporis? Qualis fuit arbor, quantum tempus, quænam cauſa, ubi lectus genialis? Omnium eſt quærere non omnium dicere.

Quid de hiſce aliiſque multis (quippe 400 ſunt Specimina*) ſentit INVENTOR, libro Phænomena Lacûs hiſtoricè & philoſophicé exhibente, forſan non ſine veritatis filo, animum, per effectuum labyrinthum, ad CAUSAM UNAM PRIMAM cautè ducente, LECTORI, PERITO, CANDIDO, BENEVOLO, dicere exoptat.

* *Horum catalogus forſan poſthac in publicum prodibit.*

Theſe white ſtones alſo upon breaking, ſometimes exhibit a more black compact ſtone in the heart, being not yet perhaps ſufficiently or thoroughly ſcorcht by the ſun. A culinary fire will in a ſhort time reduce theſe black ſtones, to the ſtate of thoſe found upon the ſhore, that is, whiter, lighter and more fiſſile.

In many parts about the lake, there are fields wherein the plough and the ſpade frequently turn them up, and they never are further regarded, than when one of them ſeems by its ſhape, fit to be uſed in ſharpening of inſtruments, the peaſant commonly ſtoops for it. And of this kind petrifications are found in gravel, even eight miles diſtant from the lake *(i)*.

The hiſtory of the healing quality of the lake, ſhall now be related.

Mr. Nevil in his obſervations on Lough Neagh, deſcribes *fiſhing bay*, (markt (r) in Grierſon's map, (fronting Lect. IV.) which has been moſt remarkable for cures in the following manner. 'This bay is about half 'a mile broad, has a fine ſandy bottom without a pebble in it; ſo that 'one may walk in it with ſafety and eaſe, from the depth of the ankle 'to the chin, upon an eaſy declivity, at leaſt three hundred yards before 'you come to that depth'.

The hiſtory concerning this bay, may be found in the Natural and Civil Hiſtory of the County of Down, pages 159 and 160.

'The occaſion of firſt taking notice of this bay for cure, is ſaid to 'have been in the reign of Charles II. in the inſtance of the ſon of one 'Mr. Cunningham, who had an evil to that degree, that it ran on him 'in eight or ten places. He was touched by the king (to whoſe royal 'touch, a virtue was at that time aſcribed of healing this diſtemper) 'and all imaginable means were unſucceſsfully uſed for his recovery: 'his body was ſo weak that he could not walk: But at length he was 'bathed in this lough for eight days, his ſores were dried up, and he 'grew healthy, married, begot children, and lived ſeveral years after; 'Many frequented the lake, who were afflicted with running ſores, 'and returned home perfectly healed. Theſe inſtances are ſo well at-

'teſted,

(i) Having thus finiſhed the hiſtory of petrifications, it may be proper to declare, that whereas in the advertiſement to Lect. 3. it is ſaid the collection conſiſts of above a hundred articles more than the printed catalogue contains, now having determined the number of articles, neceſſary to be given in print, the reader may be informed, that the collection conſiſts of above three hundred articles more than are printed; and which are well worth obſervation.

‘ teſted, that they admit of no diſpute, yet we can ſcarce be perſuaded,
‘ but that this lake was much more early remarked for the healing pro-
‘ perty aforeſaid, than the period here aſſigned; though it might in a
‘ long tract of time have gone into diſuſe, and be neglected and for-
‘ gotten: The very name of it ſeems to hint at this quality; Neaſg and
‘ Neas in Iriſh ſignifying an ulcer or ſore, how eaſy is Neaſg corrupted
‘ into Neagh.

‘ The chymical analyſis of the water diſcovers nothing in it peculiar or
‘ different from the contents of other loughs or waters of other bays in this
‘ kingdom, all of them exhibiting very nearly the ſame ſort of reſiduum,
‘ as particularly appeared by experiments made in concert on the waters
‘ of this lough, and the famed Lough-Leighs, or the healing lough, in
‘ the County of Cavan, each yielding upon evaporation a ſmall quantity
‘ of bituminous, or at leaſt ſulphureous matter, from which they both
‘ ſeem to derive their healing quality before hinted. For it is ob-
‘ ſervable, that the ſolid contents of theſe waters, differ greatly from
‘ thoſe of moſt common ſprings, which generally contain a diſſolved na-
‘ tive lime-ſtone, which the waters of theſe loughs do not; but a dark
‘ brown viſcid matter, ſparkling, ſtinking, and burning black on a red hot
‘ iron; and herein they differ greatly from the petrefying waters of this
‘ kingdom and Great Britain, which abound with lime-ſtone, and whoſe
‘ petrifications are a true native lime-ſtone.

It is very probable the water of this lake had a great fame for a ſa-native quality, before the experiment was tried on Mr. Cunningham: Otherwiſe what ſhould induce him to an experiment of this kind. ‘ Are ‘ not Abana and Pharphar, rivers of Damaſcus, better than all the waters ‘ of Iſrael’, is a ſentiment natural enough to thoſe who only mean to uſe natural means. If this gentleman was of England, he would probably have thought it more prudent to have uſed any pool in his own neighbourhood, than to go to another kingdom, and to a part of it that was then very ill cultivated †: If he was of Ireland, what occaſion had he to go to the king, when he had the better means nearer at hand *. Take the ſtory in any light, and it ſufficiently proves the reputation theſe waters bore, even ſo early as the reign of King Charles the ſecond. Such reports always ariſe from unſought occaſions, rather than de-

ſigned

† If the fame of the lake was not very extraordinary.

* Perhaps the opinion of the royal touch was then moſt credited, and that failing, the other was tried.

ſigned inquiries. The curing of mangy dogs in the County of Cavan, gave riſe to the fame of the lake there, the virtues of which were often tried afterwards on human bodies. The firſt occaſion of the fame of Lough Neagh in this reſpect, records do not relate: Perhaps, if they did, it would be as idle as the ſtory of the origin of the lake, which has too many circumſtances of an old woman, and a pitcher, and a well, and a door, and a ſudden overflowing of that well, ſo as to form a lake becauſe the door was left open, to be related in a ſerious book. The purpoſe here is to ſhew, that the waters of Lough Neagh have had a reputation of healing diſorders of bathers for many years paſt; and that it ſtill continues to have this reputation, the numbers of people who go from Dublin and other places to Fiſhing-bay, and to Lurgan, in order to bath in the lake during the ſummer ſeaſon, are ſufficient to teſtify. The phyſical cauſe of this quality in the lake, and that of petrefying, if it has both or either, ſhall be inquired into and aſſigned in the following lecture.

The GEMS and cryſtals, deſcribed in the latter part of the lecture of metamorphoſes, deſerve alſo a place here, as hereafter in two places more; being not only new in this part of the world, but valuable alſo in their kinds. The reaſon of mentioning them in the catalogue, was to deſcribe their natural forms; the reaſon of mentioning them here, is to deſcribe the places of finding them; the reaſon of mentioning them in the phyſical lecture, is to aſſign the phyſical cauſes of the productions, and the reaſon of mentioning them in the phyſico-mechanical lecture, is to ſhew the uſes that are made of them, after they paſs through the hands of artiſts, as well as the religious and civil regard that has early been paid to them in theſe laſt reſpects.

Very little will ſuffice for the purpoſe of this lecture. All Gems contained in our catalogue were found looſe upon the ſhores of Lough Neagh, in the compaſs of very few miles, to wit, between (*v*) and (*s*) as markt in Grierſon's map. The large cryſtal in particular weighing two pound two ounces, whoſe ſurfaces are delineated in a diminiſhed form *, was found at (a). And the fragments of a very large and beautiful colourleſs cryſtal elſewhere mentioned in theſe lectures, and preſented

*Fig. 5. of Plate 6. fronting Lecture V.

to a worthy Gentleman in Dublin, was found in a turf bog, on the very ſurface of it, about three miles into the country. Mr. JOHN STOTHARD in the neighbourhood of the lake; a Gentleman of the higheſt eſtimation where honour and generoſity bear a price, two GEMS like thoſe natural gems in the breaſt-plate of Aaron, which contained all the tribes, as theſe do all other virtues, was the worthy perſon upon whoſe authority this was related. It was likewiſe in part of his demeſne, that the Inquirer found ſome of the agats, as well as at a hill *(p)* about five miles from the lough, in the County of Antrim. In the ſame hill was found a great deal of Talk. For a large vein of it was diſcovered ſome years paſt, when the late Lord Viſcount Conway was ſearching for coals. Upon the ſhore of the lake near the river Main, were found the brown cryſtals mentioned in the lecture of metamorphoſes; and alſo page 94, where there was a reaſon for mentioning the Well, called Cranfield, which in ſome meaſure made it expedient to anticipate this part of the deſign: Referring therefore back to what is ſaid of the well, here it is neceſſary to beſtow ſome words upon a remarkable bed of that cryſtalline matter about four miles diſtant from the well, and very near the mouth of the river Main.

For ſome ſpace along the ſhore, in that part of the lake, is a kind of quarry, of a ſort of rotten ſtone, or a rock that has hardly conſiſtence, ſufficient for the moſt ordinary building; for a peaſant broke it up pretty eaſily with a ſpade. Between the interſtices of this rock, which in many places were of two and three inches breadth, tranſparent brown cryſtals grew, ſhooting one into another, ſo as to make a cloſe and compact congeries. They ſeemed to grow from each rock, in ſuch manner, as to fit themſelves into the irregular interſtices of thoſe growing from the oppoſite rock, that no void ſpace was left, in which a pin could penetrate: The figures of theſe can not be determined. For they are of all ſorts of irregularities. Yet the whole maſs is exceedingly like that of brown ſugar when it is candied; that is, when the maſs is of the beautiful and elegant kind. For the generality of it has a great degree of foulneſs in it, and has no ſort of beauty.

Theſe cryſtals are extremely brittle, not being capable of being applied to any ſort of uſe, in reſpect to the decorations of human apparel.

Maſſes

(p) Called Megabery, being the eſtate of the Right Hon. the Earl of Hartford.

Maſſes of them would become grottos exceedingly well; and by digging ſufficiently deep, great quantities may be raiſed. Towards the upper part of the ſhore, where the lake reaches only in its higheſt ſtate of flood; there is a ſort of a ſod, the greateſt part of which is this cryſtalline matter, kept together ſeemingly by the roots of the graſs which grows amongſt it.

Theſe cryſtals along with ſome of the white kind, both of Lough Neagh and Kerry, were put into crucibles, and ſubmitted to the influence of intenſe heat, the reſult of which is expreſt in the following letter of a young Gentleman already mentioned with credit.

'The brown brittle matter like ſugar candy of Lough Neagh, became lime in an hour, in an air furnace, and after ſix hours it did not ſeem to be altered farther.

'The white cryſtals of Kerry and Lough Neagh were put into crucibles, which were put into an air furnace with a very ſtrong heat. After one hour one crucible was removed, and the cryſtals ſeemed to have undergone very little change, more than acquiring a reddiſh colour, which perhaps may have been occaſioned by ſulphur, which had been burned in the ſame crucible before.

'After ſix hours the other crucible was removed from the fire, and the cryſtals, I thought, ſeemed more bright than before, and more brittle, and had many cracks in them, but no other way altered.

ROBERT DAVIES.

In the abridgment of the Philoſophical tranſactions, the brown cryſtals which became lime in one hour, and perhaps ſooner, are mentioned, Vol. 2. Page 464. being an extract of a letter from Sir Robert Redding.

'I ſend you herewith ſome ſtones of an amber colour, taken out of a ſpring called Cranbourn ſpring, near Lough Neagh, which the country people tell us, grow at the end of a little ruſh, and drop off, and are to be found only on May-day eve, and good for God knows what: They look like the germinations of ſome of your ſalts but in the fire give no ſigns thereof by crackling: They are electrical and angular, and being pounded, the powder is white.

To which he might have added, had he tried, this powder ferments with ſpirit of vitriol. If they are electrical, it is in ſo ſmall a degree as ſcarce deſerves notice.'

This

This account was taken haſtily from the people of the place; they are found in plenty two miles from the ſpring, and any time in the year.

Although theſe ſubſtances are here called cryſtals, yet perhaps it would be more agreeable to the diſtinction of things commonly uſed by the naturaliſts, to call them fluores; which are ſubſtances, inferior to cryſtals, as ſome ſay (s); were it not that theſe tho' very brittle, almoſt ſplitting with the preſſure of the nails, yet do not flow in an intenſe fire to a liquid metal of glaſs, if that be what ſome naturaliſts mean by *fluunt*.

'Doctor Woodward ſays of fluores; they do not flow but are calcined by intenſe heat, and are uſeful in fuſion of metals, as lime by abſorbing the ſulphur, which would otherwiſe prevent the metal to flow.' The experiment therefore mentioned is to the purpoſe, and determines that theſe are fluores in Doctor Woodward's ſenſe, becoming lime. And by a hammer or peſtil they are eaſily reduced to a white powder.

(s) Schuitzer ſays page 242. iter alpinum. Lug. Bat. Ita videtis in cryſtallorum conſortium accerſo fluores, ita a fluendo dictos, quod in igne fortiori fluant & metallorum fluxum promoveant———A cryſtallis non differunt niſi inferiori mollitiei gradu, ita ut gemmas nobiliores duriſſimas, cryſtallos duras nec tamen ab igne liquabiles, & fluores molliores in igne fluxiles hexagonâ plerumque figurâ gaudentes ſubordinanda invicem putem.

'The ſpecimen deſcribed by Woodward under the character of a gloſſy, talky, yellowiſh ſpar, ſomewhat reſembling brown ſugar candy, is perhaps of this kind.

Cat. Engl. foſſils, part I. page 148, 150.

THE

THE

PHYSICAL LECTURE,

OR AN

E S S A Y

TOWARDS

Solving the Phænomena deſcribed,

BY

Aſſigning the true, or moſt probable Phyſical Cauſes.

L E C T U R E V.

There are certain waters which condenſe wood, and other light bodies into a ſtony matter, ſo that the lower part of the body, which was under the water, ſhall be ſtone, and that above, remain wood; and hereof I myſelf have ſeen inſtances: This is a particular which ſhould be well inquired into, as it may afford great light in the practical buſineſs of condenſation. Hiſtory of Condenſation &c. by Lord Verulam, abridged by Shaw.

I ſee not, why natural knowledge muſt be more proſperouſly cultivated by ſelfiſh naturaliſts, that aim but at the pleaſing of themſelves in the attainment of that knowledge; than thoſe religious naturaliſts, who are invited to attention and induſtry, not only by the pleaſantneſs of the knowledge itſelf, but by a higher and more engaging conſideration; namely, that by the diſcoveries they make in the book of nature, both themſelves and others may be excited, and qualified, the better to admire and praiſe the author.

Boyle, Excellency. of Theology, &c.

The things, which theſe proud men deſpiſe,
(And call) impertinent, and vain, and ſmall,
Theſe ſmalleſt things of nature, let me know,
Rather than all their greateſt actions do. Cowley.

PROLUSIA.

BR. III.
B.F.L.M.U.

Plate 6. fronting Lect. 5.

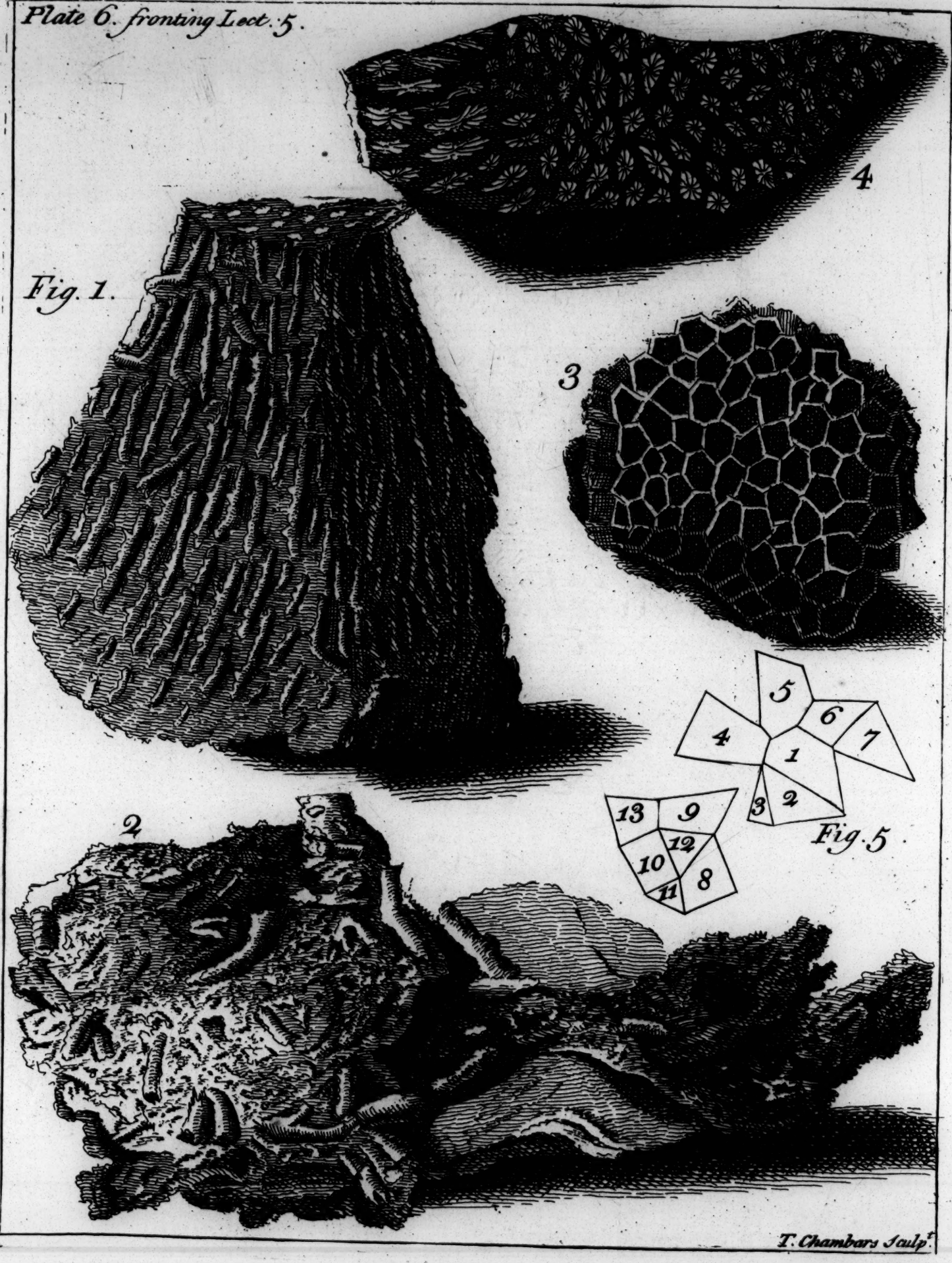


Fig. 5.

T. Chambars Sculp.

LECTURE V.

BEING arrived at a main part of our buſineſs, to give the phyſical cauſes of the phænomena deſcribed, there can be no better introduction than the model of the noble deſign, of the foundation of the ROYAL SOCIETY in England, as the excellent hiſtorian relates it *.

'Their purpoſe is, to make faithful records of all the works of nature 'or art, which can come within their reach; that ſo the preſent 'age, and poſterity may be able to put a mark on the errors, which 'have been ſtrengthened by long preſcription; to reſtore the truths, that 'have lain neglected; to puſh on thoſe, which are already known, to 'more various uſes, and to make the way more paſſable, to what re-'mains unrevealed. This is the compaſs of their deſign. To accom-'pliſh this they have endeavoured———and ſtudied to make 'it not only an enterprize of one ſeaſon, or of ſome lucky opportunity; 'but a buſineſs of time; a ſteady, a laſting, a popular an uninterrupted 'work.———Our churchmen the greateſt and moſt reverend, by their 'care and paſſion, and endeavours in advancing this inſtitution, have 'taken off the unjuſt ſcandal from natural knowledge, that it is an enemy 'to divinity.——We are to overcome the myſteries of all the works of 'nature, and not only to proſecute ſuch as are confined to one kingdom, 'or beat upon one ſhore.

With regard to theſe excellent ſentiments of a moſt honourable ſociety, the foregoing, preſent, and following lectures are compiled; and for which that excellent writer has already ſufficiently apologized; it being highly becoming a clergyman, to intereſt himſelf in the phænomena of the natural world, which is the handy-work of God, whoſe miniſter he is, and whoſe works are the objects of ſtudy, to the members of that

* Sprat, Part II.

noble ſociety, who have eminently diſtinguiſhed themſelves near a century. Yet we can not enter upon this part of our taſk, which now is incumbent upon us, without ſome more of that writer's elegant and moral ſentiments, which equally concern the ſpeaker in philoſophy, and the hearer; the writer, and the reader.

'What great things can ~~be~~ expected, if mens underſtanding ſhall be, 'as it were, always in the warlike ſtate of nature, one againſt another? 'If every one be jealous of another's inventions, and ſtill ready to put 'a ſtop to his conqueſts? Will not there be the ſame wild condition of 'learning, which had been amongſt men, if they had always been diſ-'perſed, ſtill preying upon and ſpoiling their neighbours? If that had 'ſtill continued, no cities had been built, no trades found out, no civi-'lity taught: For all theſe noble productions, came from men's joining 'in compacts, and entring into ſociety. It is a uſual ſaying, *where the 'natural philoſopher ends, the phyſician muſt begin,* and I will alſo add, '*that the natural philoſopher muſt begin, where the moral ends.* It is 'requiſite, that he who goes about ſuch an undertaking, ſhould firſt 'know himſelf, ſhould be well practiſed in all the modeſt, humble, 'friendly virtues; ſhould be willing to be taught, and to give way to 'the judgment of others. And I dare boldly ſay, that a plain induſtri-'ous man, ſo prepared, is more likely to make a good philoſopher, than 'all the high, earneſt, inſulting wits, who can bear neither partnerſhip, 'nor oppoſition. The chemiſts lay down, as a neceſſary qualification 'of their happy man, to whom God will reveal their adored elixir, that 'he muſt be rather innocent and virtuous, than knowing. And if I were 'to form the character of a true philoſopher, I would be ſure to make 'that the foundation: Not that I believe God will beſtow any extraor-'dinary light in nature on ſuch men, more than others, but upon a 'bare rational account. For ſuch men, whoſe minds are ſo ſoft, ſo 'yielding, ſo complying, ſo large, are in a far better way, than the 'bold aſſertors; they will paſs by nothing, by which they may learn; 'they will be always ready to receive, and communicate obſervations; 'they will not CONTEMN THE FRUITS of OTHERS DILIGENCE, 'they will rejoice to ſee mankind benefited, whether it be by them-'ſelves or others.

Intending

Intending to uſe the modeſty here required, and hoping for the humanity and tenderneſs deſcribed, we now enter upon the buſineſs.

THE DESIGN of the preſent lecture is to ſpeak concerning the cauſes of the petrifications, the ſpecimens of which ſtill lie in your view.

Before this ſubject can be fairly handled, it may be proper to ſay ſomething of the manner of explaining natural phænomena, and to determine, when an appearance may with preciſion be ſaid, to be accounted for.

The appearances of natural things are infinite, and the fancies of mankind as much ſo; he knows moſt of nature, who has obſerved moſt appearances with judgment and memory, ſo as to make compariſons to find out the regular courſe of things, that is, the laws by which the material world is governed. For the Author of nature always acts wiſely, and is not under a neceſſity to make new laws for new occaſions, but has *fixt the courſe of things*, and never deviates from THAT; except upon ſome extraordinary events, to demonſtrate, for the ſake of moral agency, his power over the matter of the Univerſe. When that is the caſe, the deſign is always declared; but when no ſuch deſign is declared, the common laws of the Univerſe, muſt be the ſolution of the uncommon, as well as of the common phænomena of the Univerſe. For the ſolution of a phænomenon is, the attributing of it as an effect to its proper and immediate cauſe; for if that is not allowed to be a ſolution of it, inquiries become endleſs, or are immediately ſtopped. For if the cauſe of a cauſe, of a cauſe, is asked without limitation, the human mind has no place to reſt; and if every phænomenon is immediately reſolved into one common cauſe *(k)*, *the Divine Will*; all inquiry ſhould ceaſe. But the courſe of things muſt oblige us to confeſs, that although the author of natural things does every thing by his will exerted according to wiſdom, yet he chooſes in a great variety of caſes, to act by the mediation of inſtruments of his own contrivance; and yet every inſtrument is inactive without his immediate activity upon it. Whether or no it were not becoming infinite wiſdom, to act immediately without ſuch mediation, ſuits not

(*k*) In miraculum ſeu voluntatem Dei extraordinariam reſolvitur, ad quam tamen in phyſicis ſine neceſſitate confugiendum non eſſe, convenit inter intelligentes.
Friend Chem. Append.

this place to inquire. Natural philoſophy is that part of knowledge which ſhews the courſe of things in the material world; and an appearance may be ſaid to be accounted for, when its order is ſhewn in that courſe of things, that is, when the immediate cauſe of it is aſſigned: If the appearance be out of the reach of experiments, then ſomething ſimilar is conſidered, and the cauſe of one is very juſtly ſaid to be the cauſe of the other. For the Author of Nature does not mean to puzzle the ſtudents in this courſe of things, but to the ſame effects for the moſt part gives the ſame cauſes, and if the refraction of light occaſioned by human art, exhibits an artificial rainbow, ſo does the refraction of light in globules of water raiſed in the atmoſphere, exhibit a natural rainbow.

To come nearer therefore to the buſineſs in hand, it ſhall be demonſtrated that all water has a principle of petrification *(a)*.

The cruſt which grows upon copper *(b)* veſſels, in which water is boiled for common beverage, is a good proof of this, together with the diſorder incident to human bodies called the ſtone *(c)*. For all beverage

(a) This ſhould have taken place in a preceding lecture, if the cloſeneſs of the relation to the preſent purpoſe when the truth of it ſhould be freſh in the readers memory, was not a good reaſon for inſerting it here. And becauſe a late writer (Mr. Hill) has very well handled this matter, the text remaining as it was before our acquaintance with his book, his ſentiments may be conſidered alſo.

(b) There is no water perhaps, that will not occaſion a cruſt in kettles, of the form of thoſe which are uſed for tea, wherein the water frequently continues long boiling, and the vapour is much confined, in ſo much that the incruſtation has ſometimes been obſerved in the lid of the ketile, where the vapour alone could be the cauſe.

(c) Warmth has a conſiderable ſhare in the production of theſe phænomena. To this purpoſe ſee the following narration concerning Hierapolis in great Phrygia.

R. Pococke, his deſcription of the Eaſt.

The warm waters here, are the greateſt natural curioſities in Aſia; they riſe to the ſouth of the theatre in a deep baſon, and are very clear; they are only tepid, have the taſte of Pyrmont waters, but are not ſo ſtrong, and muſt have in them a great quantity of ſulphur: They do not drink them, tho' I could not perceive either ſalt or vitriol in the taſte of them, to make them unwholſom. The ſprings flow ſo plentifully that they make a conſiderable ſtream: It is obſerved by the antients, that theſe waters were excellent for dying, and that the roots of the trees in this place, gave a tincture equal to the ſcarlet and purple; and now there are ſhrubs growing about the hill, the roots of which are incruſted with a petrification of theſe waters, which might be uſed in dying. The water now runs in channels about three feet wide, which are incruſted on each ſide to the thickneſs of abour

rage however rendered palatable by mixtures and brewing, and flavours of particular plants, acquired in the manner of natural growth, is really water as to its principal content *(d)*. The river Sein which paſſes through Paris, is remarkable for incruſting the inſide of water pipes with calcarious matter, ſo as to ſtop the flux of water in them; and it is not uncommon in that city, to cut for the ſtone in human bodies, at the age of ſeven years. But this is not an univerſal connection of effects, the ſame

about half a foot. The ſide of the hill where the water runs, is covered with a white incruſtation, and the channels which conveyed it through the city into the plain, are intirely filled; as well as the arches of the aquæduct, all appearing like the ſolid rock; and I obſerved towards the brow of the hill, ſome hollow parts, where the rain water has ſettled, round which there are partitions of a white ſulphureous incruſtation, probably occaſioned by the motion of the water in windy weather; and in ſome parts there are little heaps, which appear like white ſalt, but are ſolid ſtone. In one part where the water runs down the hill, it forms a moſt beautiful hanging petrification like rock work; the ſides of the hill appearing as white as ſnow; and poſſibly they might call this place Pambouk-Kaleſi (the caſtle) from its reſemblance in whiteneſs to that of cotton.

Upon this account of the learned traveller, it may be remarked that the warmth of the water, contributes greatly to the production of the above mentioned phænomena, and is ſimilar to thoſe common amongſt us in the tea-kettles. The particular phænomenon in the cavities towards the brow of the hill, might perhaps more truly be attributed to a ſteam ariſing from the warm water, which would produce this effect beſt in calm weather. For wind would diſſipate the matter. And the ſame phænomena would frequently appear in the lids of tea-kettles, were it not for ſcouring which they eaſily admit.

If this water was cold, perhaps it would not produce any one of theſe phænomena.

See alſo Kircher in his Mundus ſubterraneus. Lib. V. Sect. 2. § 7.

Prope Roncolanum Senenſis territorii oppidum duos fontes calidos obſervavis quorum aqua per canales ad molares rotas vertendas ducebatur. In hiſce canalibus Cyperus, junci, ranunculus, ſimilesque herbæ tanta adoleſcebant fæcunditate, ut quotannis eas, nè aquæ motum interturbarent, extirpare oporteret, extirpatas vero projectaſque in vicinum locum, herbas omnes in lapidem converſas non ſine admiratione ſpectavi. Cujus rei cauſam cum a molitoribus quærerem reſponderunt, aquas iſtius modi hujus virtutis eſſe, ut quæ intra Canales aut in ipſâ aquâ excreverint herbæ, mox ac extirpatæ fuerint, lapideſcent, quæcunque vero extra aquam in campis patentibus excreverint herbæ, iſtas extirpatas nunquam lapideſcere.

Kercher, Mundus Subterraneus. Lib. V. Sect. 2. § 7.

(d) Non aliter inter ſe diſcrepant fluida, quam figurâ magnitudine, viribuſque attractricibus corpuſculorum, quibus humor aqueus imprægnatur, qui communis, omnium fluidorum baſis videtur eſſe. Unde tot aquarum genera virtute diſſimilia? Eſtne quod ſalium ac mineralium corpuſculis ſaturentur? Quid diverſum vinum quid cereviſia habet, præter particulas uvæ hordeique in aquâ innatantes? Nonne omnes etiam ſpiritus, ex particulis ſalinis aut ſulphureis in aquâ diſſolutis conſtant?

Ja. Keil. Tentamen quartum.

ſame water that petrefies inanimate ſubſtances, does not always produce this diſtemper in animal bodies, when it is uſed as beverage *(e)*.

This may be expreſt otherwiſe, and alſo demonſtrated in another manner.

LEMMA I.

All water is capable of hardening into ſtone.

DEMONSTRATION.

In moſt or all ſubterraneous apartments formed by nature, and even in artificial vaults, lapides ſtalactites are found; the Inquirer has found them himſelf in ſeveral caves, he has heard and read of them in many more: Now as the gravities of all bodies, is aſſerted upon experiment being made upon many without an exception, ſo alſo may this property of water be aſſerted, from theſe phænomena being obſerved in all parts of the world, under the ſame ſimilarity of circumſtances. The reaſon why theſe phenomena are more frequent in caves, than elſewhere, is, that the water flows there very gently, there being no agitation of the air, ſo as to form pendent drops, ſome of which hardening above, begins a conical hardened ſubſtance; more water flowing covers that with a thin coat, which alſo hardens, and partly forms a liquid drop at the end, which either hardens there, or falls and begins another cone below, which ſometimes increaſes and riſes in proportion, as the upper cone increaſes and deſcends; till at laſt in ſome inſtances, the cones meet

(*e*) Having viſited the incruſting ſpring formerly mentioned, I obſerved, that about the ſpring head there was only little moſs incruſted; but forty or fifty yards from it, where the water hath a fall higher than my head, it ſheathed every thing with ſtony caſes, and makes the ſides of the bank hard rock. It bears ſoap, freezes quickly, and waters ground with advantage; it is uſed in the kitchen and brew houſe belonging to the Gentleman in whoſe ground it riſes, without any ſenſible ill effects; except that his horſes are ſhort breathed. Extract of Mr. Locke's letter in Boyle abridged by Boulton, Vol. II. p. 368. See alſo Boerhave Elements of Chemiſtry, page 352, London 1735.

There are ſome waters which are endued with a petrefying quality, as is obſerved in the petrefying cave at Burgundy, about a mile diſtant from Quingey, where the water as it drops down, petrefies into ſtatues of all kinds of figures, Journal des Scav. 1688 p. 432. And yet what is particularly ſurprizing, theſe petrefying waters do not generate ſtones in the human body. Mem. de l'Academie roy. des Scav. 91, 92.

meet, and form one continued pillar. In many caſes where the water paſſes through one ſmall aperture, it preſerves a perforated cavity through the length of the ſtalactites.

If every cave does not afford ſpecimens of the ſtalactites, it is becauſe ſome of them are dry and cold; or perhaps the water flows, in too great abundance, and too rapid a motion; for the quantity and motion ſhould not cauſe a ſtream but drops, and the cave ſhould be free from all intercourſe of turbulent air, and ſhould alſo be warm, that this ſeemingly lapideſcent vegetation, or rather accretion, may be perfected (*f*). The ſtones thus formed ſometimes take a fine poliſh, and may be

(*f*) Petrifications of matter denſer than water, may be formed in various manners. The following account of petrifications relate to this. London Evening Poſt, Nov. 29: 1749.

It is not eaſy to enumerate to you, the many improvements of which Gibraltar is capable. An able hand might here find materials for a natural hiſtory——————You have the common ſand petrefied into ſo hard a ſtone, that the platforms for the great guns, are made thereof, as the moſt durable of all others; and you ſee the gradual progreſs of this petrification.——There are two models of the works made, which are great curioſities. The bodies are compoſed of ſand ſtrongly cemented with oils, and now become a very hard ſubſtance, &c.

This account may be compared with Pliny, Nat. Hiſt. lib. 35. cap. 13.

Quis ſatis miretur pulverem ſive arenam in puteolanis collibus opponi maris fluctibus merſumque protinus fieri lapidem unum inexpugnabilem undis, & fortiorem quotidie, utique ſi Cumano miſceatur cæmento. Eadem eſt terræ natura & in Cyzicenâ regione.

At Dunlery near Dublin, there are large congeries of gravel fallen from a very high bank, and ſome years expoſed to waſhing and ſprit of the ſea, which although ſo looſe at firſt, that with a finger the pebbles might be pickt out of it, in a ſhort time became ſo hard, that a ſmart ſtroke of a hammer may break the prominent pebble, without looſening the part cemented to the maſs. There are hardened maſſes of the ſame kind, on the ſhore between Tralee and Dingle: Alſo maſſes of petrefied clay at Youghal, of a bank about 90 feet high, called clay caſtle, which it is feared will not long be a ſufficient barrier to the ſea, although the ſea ſeems by its petrefying quality, to be diſpoſed to make a barrier to itſelf.

There are many large congeries of mixt matter, conſiſting of ſand, gravel, and hardened clay, found in and about the Iriſh Lake, even concretions of ſand are found in the cavities of the petrefied wood, as ſome ſpecimens in the catalogue demonſtrate: But the petrification of the wood, is a very diſtinct phænomenon and is owing to another cauſe; as what follows will plainly demonſtrate. As well as that the ſtony concretions upon the teeth of man, which ſometimes require filing is a different phænomenon, and is owing to another cauſe, than the oſſification of the man, whoſe ſkeleton was ſome years paſt in the poſſeſſion of Dr. Barry, Vice-Precident of the Phyſico-Hiſtorical Society, and is ſtill.

The muſcles of this man's arm was almoſt totally turned to bone, and there grew one ſtrong bone from the occiput down the neck and vertebræ of the back, ſo as to render him incapable

be wrought into urns, and vaſes of other forms, a beautiful one may be ſeen in the collection of Mrs. Delany, at Glaſnevin near Dublin, a lady of whom we have occaſion to ſpeak in the handſomeſt manner in another place.

But we muſt diſtinguiſh between three kinds of petrification, beſides water petrefied.

I. Such as exhibit only a cruſt upon the ſurface of the body, ſpecimens of which are to be found in many fountains, on moſs and leaves of trees; when the internal ſubſtance is ſometimes waſted, ſometimes it is not.

A ſecond kind is that, where the ſurface is not only incruſted, but the pores of the body are in ſeveral places ſo filled with petreſcent matter, as to acquire the nature of ſtone, with the viſible appearance of the firſt ſubſtance; in other places the petreſcent matter not entring, leaves the body in that part in its firſt form.

* A third kind is that, where the petreſcent matter, has ſo ſaturated the whole maſs, that it has totally acquired the nature of ſtone, retaining only the viſible appearance of the former ſubſtance.

That there need be no ambiguity in theſe diſtinctions, or the reaſoning conſequent to them, it is neceſſary alſo to diſtinguiſh accurately wood and ſtone.

Wood is a body fibrous to the taſte, tough, and capable of having its parts ſeparated by an edged tool, by preſſure alone; exciting the idea of a hollow ſound upon being ſtruck, and emitting fire upon violent friction, but not upon a ſtroke; and when ſet on fire, blazing and conſuming to aſhes.

Stone is a body gritty to the taſte, brittle and incapable of flexion, blunting the edge of tools, whoſe parts are ſcarce ſeparable by preſſure, but more eaſily by a ſtroke, which excites the idea of a brisk ſound, emitting

incapable of flexion. It is hoped the literati will be informed of this extraordinary appearance of an animal body, by an accurate deſcription, under the direction of the proprietor: There is in the Natural and Civil Hiſtory of the County of Cork, publiſhed laſt year in this city, a ſhort account and graving; which Mr. Smith the Author (mentioned page 63) would probably have given compleatly, if the honour of that was not left for the worthy poſſeſſor; whoſe great buſineſs in the medical way, has retarded his deſign. The calculary of ſome pears too hard for teeth or knife, is a phænomenon proper to be conſidered along with this; as well as the ſtony concretion which ſometimes grows upon the teeth.

* Mr. Charles Maſon's firſt Letter, not prefixt to theſe Lectures, mentions diſtinctions ſimilar to theſe.

emitting fire upon friction, and alſo upon a ſtroke, and bearing a great degree of fire without conſumption.

Becauſe ſome mention ſhall be made and has been already, of bone converted into ſtone, it may be proper here to ſtate alſo the true properties of bone as diſtinguiſhed from ſtone. Bone will yield to a knife ſo as to part in ſlices larger or ſmaller, according to its thickneſs, which ſtone will not do *(m)*, tho' in ſome inſtances it may be broken thereby into irregular lumps; ſmall fragments of ſtone are gritty between the teeth, but theſe of bone are not *(n)*. Bone may be ſoftened into a mucus

(*m*) It is to be wiſhed the anſwer to the following query was fuller. Stone may ſplit in a grain like wood, but not curl like chips, or ligneous ſhavings.

Q. Whether the quarries of ſtone in India, near Feticopa, not far from Agra, may be cleft like logs, and ſawn like planks, to ciel chambers and cover houſes.

A. What they are about the place mentioned, I have not as yet been well informed; but in Perſia not far from Cyrus where the beſt wine groweth, there is a ſort of hard ſtone, which may be cleft like fir-wood, as if it had a grain in it; the ſame is at the coaſt Cormandel about Sadraſpatuam; where they make but a mark in the ſtone, ſet a wedge upon it, with a wooden hammer, as thick, and thin, as they pleaſe; it is uſed commonly for pavement in houſes, one foot ſquare, and ſo cheap, that ſuch a ſtone finely poliſhed coſts not above ſixpence. Sprat. Hiſtory of the Royal Society.

There are accounts given of wood in America, anſwering many purpoſes of iron and ſtone. Marvelous things concerning vegetation we do not chuſe to relate, unleſs they are extremely well atteſted, and concern the ſubject in hand. Yet one thing, of which the Inquirer was an eye witneſs, he will take the liberty to mention here, not knowing where elſe he can ſo properly introduce it, and being a phænomenon of great novelty to him, perhaps it may not be quite familiar to the reader, and therefore agreeable.

In the gardens of the Reverend John Standiſh, near Lough Neagh, a Gentleman, who is too well ſatisfied with the trueſt retired worth of a good Clergyman, to deſire praiſe here, the Inquirer was informed by that worthy perſon of an extraordinary growth of Colewort, which he had to ſhew. It was a tall plant amidſt many others, pretty much of one ſtature, growing under an apple tree: Each leaf had upon the middle ſtalk, and alſo in other parts of the leaf a great number of ſimilar plants, growing from it in miniature, with the intire furniture of ſtalk and leaves; to the height of three and ſix inches. For they were of different ſtatures. Every leaf ſupporting a little garden, of this kind, to the number of ten or a dozen, made the whole plant of a very beautiful appearance. The preſent Lord Biſhop of Kildare dining there one day, a leaf was brought into the houſe to be ſhewn to him. The proprietor meant to have preſerved the plant, to learn what the iſſue of this uncommon vegetation would be, but his gardener indiſcriminately pulled it up with the reſt, at an unſeaſonable time.

(*n*) The yoke of an egg may be hardened, ſo as to appear to the ſight and touch to be beautiful amber, yet ſhall diſſolve in warm water; bone may be a kind of hardening of fleſh ſimilar to this, capable of diſſolution in the heat of the digeſter, or even by that of the human body, as appears from the remarkable inſtance mentioned in Spond his travels.

ſo as to become a kind of nouriſhment for animals, eſpecially in a digeſter well known to Chemiſts under the title of Papin's Digeſter, and ſome kinds in an oven; but ſtone will either not yield to fire at all, or if it does, it becomes lime or glaſs. But the comparative properties of wood and ſtone, are what we have principally to do with here.

Examine the ſpecimens before you according to theſe properties, and you will reduce them to the laſt claſſes of petrification: Some of them are intirely ſtone, in the place of what was once intirely wood; ſome are wood and ſtone ſo intermixt, that it is not eaſy to ſay which kind of matter has the greateſt ſhare in the compoſition.

Before the cauſe or cauſes of theſe petrifications be aſſigned, two Lemmas more muſt be demonſtrated.

I. Concerning the univerſal attraction of matter and coheſion of particles in contiguity.

II. Concerning the effects of conſtant preſſure, and the poroſity of all bodies. Theſe might have been propoſitions in the firſt lecture, and have been demonſtrated there, but their cloſe relation to the reaſoning which we are about to uſe immediately, makes it more convenient to deliver them here. And although that reaſoning depends alſo upon a conviction of the truths demonſtrated in the firſt lecture, yet thoſe of immediate application in reaſoning, ſhould have alſo proximity of ſituation.

LEMMA. II.

Every particle of matter attracts every other particle of matter, and when brought to contiguity there is a ſtrong coheſion.

DEMONSTRATION.

The material maſſes of which the world conſiſts, are all kept in their forms by this principle; and whatever brings the particles of ſtone together, it is this principle that keeps them united. Hence it is that looſe clay, when tempered and made into the form of brick, ſhall be able to ſupport a preſſure in the corner of a wall ſeveral thouſand times its own weight. Even theſe particles of matter which ſeem to repel each other at particular diſtances, ſhall moſt cloſely unite when brought to

to contiguity. Such are the particles of air which entring the pores of other bodies, unite and conſtitute part of the maſs. This coheſion in ſome inſtances ſeems to increaſe by time, as the mortar of old walls is ſometimes ſo hard, as ſcarce to admit the penetration of a tool, when that of new erected buildings will eaſily crumble.

Some fluids containing ſalts, muſt be allowed ſeveral months *(p)* and ſome of them years, before the attracting particles will form their union and ſtrike into figures. And whether there be not matter in the ſilent chemical chambers of nature, that may require ages to form a coalition can not poſitively be gainſayed without the imputation of raſhneſs.

LEMMA III.

A continuance of an equal preſſure tho' gentle, ſhall conquer a very conſiderable reſiſtance, ſeemingly inadequate to its force.

DEMONSTRATION.

There is ſomething very ſurprizing in the nature of preſſure, as indeed there is in every phænomenon of nature, when conſidered attentively ; all is *Miracle*. A quick ſtroke from a ſoft body, ſhall penetrate an exceeding hard body ; and a ſlow preſſure of a ſoft body, ſhall alſo penetrate an exceeding hard body; but in ſuch caſes is meant, a very ſlow degree of ſlow preſſure, and a very quick degree of the quick ſtroke. Hence it is that in one caſe the ſtroke of the tail of a living whale, although blunt, and ſoft, ſhall cut an oar or a boat with a ſmoothneſs equal to that effected by a ſharp inſtrument, and in ſuch a manner, that he who handles the oar ſhall feel nothing of it. Hence it is that the roots of a tree ſhall penetrate into the crevices of walls, and even hard rocks, and by ſwelling in its paſſage burſt them.

ALL things are now prepared for giving an anſwer to the queſtion: To what cauſe is the production of theſe petrifications to be aſſigned?

There are but three natural cauſes which come into competition.

(*p*) Quædam portiones ſpiritûs cornu cervini, qualiſcunque eſſet ambientis aeris temperies, fluidæ remanebant, nonnullæ etiam ad plures menſes, & exinde ſalina corpuſcula in liquoris reſidui fundo incipiebant in cryſtallos exquiſitè figuratos abire, quorum magna ſatis copia tandem ſe prodebat. Boyl. de Fluidate & firmitate, Genevæ.

Water. The external air of the globe; and the internal air of the globe.

Is water the cauſe of theſe petrifications?

Water it is certain is a fluid of a proper denſity or weight, to carry calcarious particles of matter along with it, when it flows in a denſe body or ſtream; and if it riſes in the form of vapour from the lower parts of the earth, it is extremely inſinuating, perhaps more ſo than air; and is in this reſpect a fit inſtrument for the production of theſe rare phænomena; an inſtrument I ſay, becauſe it is in this ſenſe we uſe the word cauſe, when we inquire into the production of natural appearances, there being in the true meaning of the word cauſe, and the true ſenſe of things, but one cauſe of all things. And when we ſpeak of matter acting upon matter, and the forces of bodies upon one another, and phænomena thence ariſing, we ſpeak only according to the vulgar: For matter can not act at all, but is in all caſes only acted upon by ſome intelligent Being, which alone can have a principle of motion.

A ſtream (*e*) of water in the copper mines of the County of Wicklow, conveyed the particles of copper in ſuch abundance, that an iron pick-ax which happened to lie in the courſe of it, was in a ſhort time totally corroded, but there was a ſubſtitution of an equal quantity of copper exactly in the form of an ax. In the ſame manner water may convey particles of ſtone, according to the ſtrata of earth it flows through, and being very inſinuating it enters the pores of the wood, and depoſits its

(*e*) Doctor Woodward in his catalogue of foreign foſſils annext to Engliſh foſſils, page 52 *gives the following account* of a ſpecimen called iron turned into copper, from a ſpring near the copper mines of Hemgrunt in Hungary.

'Theſe ſprings, rivulets &c. that ariſe out of the copper mines here, are impregnated 'with much vitriol; in which there is alſo copper diſſolved. Indeed the vitriol conſtitutes 'a kind of menſtruum. Upon the putting iron in, that menſtruum preys upon it, and aſ-'ſumes the ferreous parts into itſelf: At the ſame time it precipitates an equal proportion 'of the cupreous parts; a thing common and well underſtood by refiners, and all who have 'been converſant with ſolutions in aqua fortis and other like menſtrua.'

This may explain what we are told by ſome perſons, that they make copper out of iron to profit, at Newſohl in Germany. See Shaw's edition of Bacon's works, Vol. I. p. 28.

Of late we are come into the practice of making conſiderable quantities of copper, in the County of Wicklow in Ireland, by means of iron: For one tun of iron laid in form of bars in a ſmall ſtream iſſuing from the pit, in ſeven weeks produced one tun of copper almoſt malleable, there being only one quarter of the iron corroded: This practice is becoming very profitable.

its burden: For the delay of motion which muſt neceſſarily happen, allows time for ſubſidence; when the ſtony particles are come thus together they adhere, and by long continuance the attraction becomes very ſtrong, as was demonſtrated in the ſecond lemma.

Sometimes the pores of wood are too cloſe to admit the ſtony particles, as ſeems to be the caſe of many of theſe mixt ſpecimens, whoſe firm wood tho' taken out of a bed of water, if examined immediately is found dry in the heart. Sometimes the wood is porous and ſoft ſo as to admit the water too plentifully, and allow too free a paſſage: This muſt occaſion motion, an enemy to petrification; for petrification ſeems to require reſt, when the matter proper for it is brought together (g).

That theſe petrifications are effected in this manner, ſeems alſo probable from an appearance often diſcernible in them: if the ſtones are cloven when the petrification is compleated, one may by rubbing the ſoft part of the hand upon the inner ſurface, roll up ſome fibrous parts of the wood which ſtill remain. So that there does not ſeem to be a deſtruction of the former ſubſtance to make way for the new, but rather the former ſubſtance remaining has its pores ſo filled with the new, as to acquire new qualities, and a new name. In confirmation of this, if the cloven pieces in which the fibrous parts of the wood may be rolled up, be thrown into a culinary fire, they will not only burn red hot, but alſo blaze in a faint manner; and thereby having all the wood conſumed, they

(g) In the heart of the ſpecimens of petrifications here treated of, beautiful cryſtals are ſometimes formed, and Friend's remark (Chem. de cryſtal:) as to the circumſtances of reſt is here applicable.

Iidem vero ſales aquâ calidâ ſoluti in eâ facile colliqueſcunt & ſuſtinentur, nec quamdiu ea calorem retineat, in cryſtallos concreſcunt. Motu quippe quem calor excitat vigente præpeditur atque deſtruitur omnis ille motus a vi attractrice oriundus. Cum vero aqua refrixerit & in ſe ipſa tandem quieta reſederit, ſales propriore vicinià potiti ita vim attractricem exerunt, ut inter ſe coire poſſint & in cryſtallos efformari.

And what Boerhave ſays, El. Che. p. 3, proceſs 1. is to the purpoſe.

'Theſe waters I have kept in veſſels very cloſely ſtopt, and let them ſtand very quiet, 'and after a year I have obſerved this mucilage began to be formed, and every year grew 'gradually larger, till the whole water was grown turbid. This liquor contains elementary water and the ſpiritus rector of the plant.

Is not the tartar of wine incruſting the ſides of veſſels, and the mother of vinegar alſo to the purpoſe?——As to what has been ſaid of incruſtations of tea-kettles &c. There is both warmth firſt, which implies motion, and reſt afterwards; water being often allowed to ſtand to cool.

they become more porous and light; and if they are put into the fire a ſecond or third time, they will only grow red hot, and will waſte no farther (*h*). The air upon the land effects this by corroſion, in a ſlower degree, but at laſt makes the black weighty ſtones become white, porous and light; ſuch as they are commonly found.

If it ſhould be thought that the ſand of the lake, which in many places is very fine, being conveyed into the veſſels of wood, may coaleſce, and form a mixt ſubſtance of ſtone and wood in ſome ſpecimens, and totally ſtone in others: Becauſe ſome fragments have been found on the ſhores, with ſome particles of ſand cloſely adhering to the ſurface, and ſeemingly in continuity. It may be anſwered, that the petrification is not effected, by means of the ſand of the lake, becauſe the ſpecimens of petrification hitherto tried in great heats, will not vitrify or run into glaſs, which the ſand of the lake is known to do. For the manufacture of glaſs was ſometimes carried on in the neighbourhood of it, in which the ſand of the lake was uſed to good purpoſe, till the diſhoneſty of workmen put a ſtop to it. This method therefore of accounting for the petrifications is not ſo probable as the other.

The former account might poſſibly ſuffice was it extenſive enough. But in as much as petrifications are found not only in the lake, but in the raiſed land all about it, even eight miles from it in gravel pits, or rather banks or hills of dry gravel, where water ſeems to have very little commerce: Some other cauſe muſt be aſſigned, that may extend to all caſes. For the Author of nature does not multiply cauſes, to produce the ſame effects unneceſſarily. Let the external air of the globe therefore be conſidered as a cauſe of theſe phænomena.

Is the external air of the globe the cauſe?

Air has been proved to be prædatory, and deſtructive of the forms of all bodies, which once in a growing ſtate received their forms by its aid, petrification therefore cannot reaſonably be attributed to it. The nature of wood when the progreſs of vegetation is ſtopped, is to rot by means of the penetration of air, which is a fluid ever in a ſtate of oſcillation, and conſequently motion, as nice Barometers ſufficiently teſtify, and is alſo ever changing its nature, by a diſcharge of ſome particles, and re-admiſſion of others. And being alſo an exceeding light fluid, ſome hundred times lighter than water, it is not likely to bear up the particles of ſtone. By

(*h*) See Lecture III. Number C. to CLIII. May not this property be turned to uſeful purpoſes, in making crucibles.

By propoſitions (*i*) in the firſt lecture it is certain, that the increaſe of ſurface by the diviſion of the heavieſt body, is very great and infinite; by propoſition (5) of the ſame lecture, matter is capable of infinite diviſion.

And from the laws of hydroſtatics, although heavier bodies do not ſwim in lighter fluids, that is, ſuch groſs bodies whoſe ſurfaces contain more matter, than the ſame ſurfaces would contain of the fluid, ſink: yet theſe bodies being comminuted will ſwim, as appears from the corollary of the firſt lecture. Hence it is that it is poſſible by diviſion, to comminute gold or ſtone to ſuch ſmall particles, that each ſhall contain within its ſurface leſs matter, than is proportionable to its ſurface; conſequently each particle ſhall ſwim in air as effectually, as if lighter than ſo much air (*n*). Although this be poſſible and is fact; yet upon account of the other qualities of the external air, its oſcillatory motion owing to perpetual changes of heat and cold, and its prædatory quality, it is not likely to be the cauſe of petrification. Beſides all this, the principal work-ſhop of nature for theſe petrifications, is under ground, under different ſtrata of clay, to the depth of nineteen feet, below the common influence of the atmoſphere, or external air. For although theſe petrifications may be found, ſcattered upon ſeveral parts of the ſhore, they are rolled thither by the water from their proper beds of formation; many of which ſimilar to the one deſcribed *, may be in the body of the lake. And although it be very rare to find them with wood; it is becauſe the wood is worn off in the rolling, or ſoon crackt and chipped by the ſun upon the ſhore, in which caſe it ſeparates intirely from the maſs of ſtone.

Since therefore the external air or atmoſphere, can not amount to a general cauſe of theſe phænomena; let the internal air of this globe of earth, be conſidered as the phyſical cauſe of theſe petrifications.

The internal air of the globe, is not a diſtinct fluid body of elementary matter, from the air which incompaſſes it. For by prop. 2. of the ſecond lecture. Air not only incompaſſeth this globe of earth, but pervades it. Yet the ſituation of the internal air, and the variety of material ſtrata it penetrates, and the different cauſes which rarefy and condenſe it, and its not being ſubject to thoſe violent agitations of ſtorms and

(*i*) Prop. 6, 7, 8, 9, 10, 11. (*n*) See concomitant cauſes, lect. I. * Lect. IV.

and hurricanes, render it capable of producing many effects of which the external air is incapable.

For although it holds a communication with the external air, the globe of earth being like an animal body, perpetually taking matter into it, and expiring matter out it; if not at large apertures or gulphs and cavities, that ſeem to ſwallow the ſea, a prodigious inſtance of which there is near the coaſt of Norway; and by Vulcanos, ſuch as Veſuvius, Ætna, and Hecla, by which the earth diſcharges rivers of burning matter; it is, beſides theſe, perpetually expiring, through its pores vaſt quantities of matter, which according to the ſeaſon of the year and climate, cauſe variety of phænomena, thunder, rain, epidemical diſtempers, fevers and plagues. In ſo much that miners, whoſe occupation is deep under ground, can more accurately fore tell the changes of weather above, than they who live above: And this they do, from the change of heat below, and the aſcending vapour, of which they are very ſenſible (*k*).

Notwithſtanding this communication, the internal air is capable of producing many effects, which the external can not. For in ſome places the earth is bound by froſt, which interrupts this communication for a time; although warm ſprings, which receiving their ſupply from below, and alſo heat are too powerful, for the influence of the external air, and preſerve their fluid ſtate in hard froſts.

Suppoſe

(*k*) About five leagues from Biçanſon in France, there is a cave three hundred paces deep, which in the ſpace of one day, when the weather is exceſſive hot, furniſhes ſo much ice, that the waggons and mules are ſcarce able to carry it away in eight, ſo that it riſes almoſt to a thickneſs of four feet. And on the contrary in the winter time, it is full of vapours, and a river runs in the middle of it, which is always frozen in the ſummer. *When any vapours are ſeen in this cave, they certainly prognoſticate immediate rain.* Du Hamel. Hiſt. de l' Ac. Roy. des Sc. p. 257.

The communication between the internal air of the globe, and the external well underſtood, may explain theſe phænomena: The Inquirer leaves it to the ſagacious reader, to conſider the phænomena attentively, and to apply the reaſoning here uſed, or his own reaſoning which probably is better. In ſummer the pores of the cuticular earth, if one may uſe the expreſſion, are open and ſuffer the internal vapour to expire, perhaps at ſome diſtance from the cave; in the place of which ſucceeds a freezing cold; on the contrary in winter, the cuticular pores being cloſed by the cold of the atmoſphere, the internal vapour being interrupted in its uſual courſe, is collected in the cave, and being warm muſt occaſion a thaw.

Note alſo that there are chemical experiments whereby fluid matter is made to freeze before a fire; for there are artificial colds, greater than any natural.

Suppoſe therefore this air, holding communication with the external air in ſome places and times, and ſuppoſe it interrupted in other places and times, by froſts and impenetrable ſtrata of matter; it may be capable of expanſion, and condenſation from internal cauſes, which ſhall not always affect the other, except in places where the communication is very free; and even there, as it ever ſupports larger columns of air, than that which is external to the globe, it is weightier, and conſequently more capable of bearing up particles of metal and ſtone, through the ſtrata of other matter, which by attraction may detain ſome of the particles, and ſuffer a conſiderable change in their form.

For this phænomenon of the aſcent of vapours, is frequent (*l*), and the matter transformed by it, has been lying in its bed or beds, (for many of them may be ſuppoſed, tho' only one has been yet diſcovered) ever ſince the general transformation of the world, and has therefore had ſufficient time to undergo a change (*m*).

(*l*) Over a bath in Hungary, which abounded with petrefying particles, the ſteams which were arreſted by the building over it, were turned into ſtony concretions, which may give us reaſon to think, that petrefying vapours raiſed from the lower parts of the earth, meeting with rightly diſpoſed matter, may form ſtones without the help of rain or ſpirits.

Boyl on Gems.

(*m*) Although the petrifications which are part of the ſubject of this book, are accounted for from the aſcending vapours, yet it may be fair dealing, to let the reader know what Kircher ſays,

Quæritur quidnam proprie ſit ſuccus lapidificus.

Dico eſſe ſaxum noſtrum aquâ eliquatum.———Si enim ſaxum quodcunque in pollinem tenuiſſimum reſolveris, & aquâ perfecte commixtum per manicam Hippocratis colaveris, illa nil prorſus ſaxeum, ſed præter arenaceum ſolummodo ſedimentum nihil relinquet: Si vero nitrum aut Tartarum aquâ perfectè comminutum adderis, illa, quæcunque tetigerint intra ſubjectam concham poſita, ſive frondes, ſimiliaque poſt exiguum curriculum aeri expoſita, in ſaxum ejuſdem generis convertent, ſi non totum, ſaltem cortice ſaxeo veſtient.

Quandocunque aqua pluvialis aut ex nive diſſoluta per montium rimas fiſſuraſque tranſiens, ſeſe ſaxis nitro refertis inſinuat, aut flumen aliquod tranſierit, cujus ripæ nitroſâ materiâ refertæ fuerint, tunc aqua nitroſæ materiæ vel cum minimis ejus corpuſculis perfecte vel confuſe per ramenta miſcebitur; ſi prius, tunc lævis & glaber polituſque lapis naſcetur, in eandem quoque ſaxeam materiam convertent quicquid fluore ſuo involverunt. Si vero poſterius, tunc ex ſtillicidio aquarum intra montium ſpeluncas facto, rude ſaxeum aſperum unpolitumque naſcetur, quod nunc in ſtruarum pendentium, modo in pyramidum columnarumque figuras ſucceſſivo incremento exurgit, & hoc pariter quicquid involverit, in lapidem ſibi ſimilem ex quo profluxit tranſmutat. Atque tales ſunt omnes illæ monſtruoſæ figuræ rerum, quas in iſtiuſmodi cryptis in ſaxum converſis cum admiratione ſpectamus. Si vero aqua fluminis lacuſve nitroſa hac virtute imbuta fuerit, tum herbæ & plantæ attracto lapide-

Hence is there a fair account given of all these petrifications, so as to render it probable, that they are produced by an ascending vapour, impregnated with stony or mineral particles, which if they happen to mix with the water of the lake, in their journey upward, may produce the phænomena,

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scente succo, quamdiu intra aquam steterint, humido impediente molles remanebunt; evulsæ vero & in littus ejectæ tunc attractus ab ipsis lapidificus succus, ab aeris ambientis, humidum resolventis, calore & siccitate intra exiguum tempus vel totæ in saxum, si nitrosa corpuscula saxeis ramentis atque aquâ perfectè mixta fuerint, convertentur; vel si imperfectè & confusaneâ mixturâ constiterint, tunc uti ad intima substantiæ penetrare ipsis non est licitum, ita quoque cortice tantum plantas herbas paleas ac virgulta vestient.

Quandocunque vero aquæ cujuscunque generis, præsertim intra concava montium, cum nitro & sulphure saxeæque rupis sale fætæ ramentis concurrerint, tunc succus nascetur lapidificus, qui quodcunque obvium involverit, in densam lapidis substantiam convertet: Sal enim poros aperit substantiæ, nitrum eos implet, sulphur calore suo omni humiditate expulsâ totum in ferreæ duritiei substantiam transmutabit: Cujus signum est, quando ferro percussæ tinnitum metallo œmulum similemque ediderint; cujus & hoc experimentum est, si sulphur cum nitro concoxeris totum in lapideam substantiam abire reperies.

Quandocunque vero in subterraneis penariis aquæ succos concretos, vti pyritem, mysi, soryn, melanteriam, aut calcitim roserint, aut per vitrioli fæta saxa transierint & ramentis saxi seu glebæ quæ dictorum succorum, queis continentur, veluti vasa quædam sunt, perfecte & intimè mixtæ fuerint, tunc nascetur succus quidam petrificus, qui alterius speciei saxis glebisque commixtus, ea in saxum convertit pretiosum & pro tincturæ ratione varium; si vero hujusmodi petrificus succus calore ignis subterranei elevetur, is per intimas montium saxorumque rimas agitatus, ubicunque matricem probe dispositam repererit, aut si is nitidissimus liquor fuerit, statim pro tincturæ & exactioris misturæ ratione in transparentem lapidem pretiosum vel crystallum, Beryllum, Amethystum, Topazium, Adamantem, similesque nunc magis aut minus durum, pro salis, aluminis quantitate eidem juncta, frigore loci concurrente, indurabit, quibus una magnæ dotes ex natura succorum saliumque emanantes conciliabuntur inserenturque; ut proinde hic genuinam gemmarum originem habeas.

Quandocunque vero succus petrificus ex varia nitri, alumnius, vitrioli, cæterorumque salium speciebus, diversisque mineralium glebarum ramentis, acredine dictorum salium exesis, in intimis terræ visceribus commixtus fuerit, tum ignis subterranei calore succus in vaporem resolutus, atque per saxearum substrichonum fissuras fistulasque vagabundus, ubi matricem aptam repererit, ibi vel marmor variegatum ex multiplici quâ pollet tincturâ, vel diversa jaspidium genera constituet; & quodcunque involverit, muscosæ materiæ plantulas vicinas eas pari modo una cum saxo coagulabit, unde tot herbulæ, muscı ramenta passim in lapidibus spectantur.

Quandocunque aqua sive per pluviam, sive per flumen aut per arenaceas materias & saxa, nullâ concretorum succorum saliumque copiâ referta, transierit, ea quoque propter defectum facultatis petrificæ nihil in saxum convertit: Utique in limpidissimis fontium originibus; quæ cum omni heterogeneâ miscellâ careat, ita illa quoque neque vestigium ullius saxeæ concretionis, neque in littoribus, neque in cryptarum rimis relinquet.

Mundus subterraneus lib. 8. sect. 2.

phænomena, which tradition has hitherto attributed to that water. One of the oldeſt inſtances of which tradition, is in an author of the ninth century, quoted in the Ogygia.

De tertio miraculo ſic idem Nennius (ſæculi noni author)

Eſt aliud ſtagnum quod facit ligna dureſcere in lapides. Homines autem findunt ligna, et poſtquam formaverunt in eo uſque ad caput anni, et in capite anni lapis invenitur, et vocatur ſtagnum Loch-eachac.

Hic eſt Lacus Neachus, *Echac* enim ſeu Eacha eſt viri proprium (quod Achaium latine verto, alii Eochodium) a cujus obliquo (Neacha) Lacus Neacus deflectitur; qui quidem aquifolii ligna in cotes pro certo convertit: An vero anni, aut ſeptennii ſpatio? An etiam partitur in ferrum, ut ſuperius traditur? Mihi utrumque incompertum.

To this may be added, a paſſage from Tollius.

Gemmarum & Lapidum hiſtoria, Ludg. Ba. p. 534.

In lacu Hiberniæ omne quod injicitur, vel in ferrum convertitur, vel ſi fundum petit, in lapidem tranſit.

Theſe wonders of the lake are told in verſe thus.

Eſt Lacus Ultoniæ Neachum quem nomine dicunt,
Cujus ſi quivis Aquilentam affigat ad imum,
In tres ſeptennis ſpecies diſtinguitur annis;
Pars fundo ferrum, cos fluctibus, arbor aprico.

This old tradition ſhould occaſion an inquiry into three things.

I. The kind of wood which is petrefied.

II. The time required for petrification.

III. Whether the wood admits of a transformation into iron, as well as ſtone?

As to the kind of wood continuous to theſe ſpecimens of petrifieation before you, it may in the firſt place be declared, that they are not holly, although that be the prevalent opinion; that is, ſuch of them as belonged to thoſe diluvian ſtrata hitherto deſcribed; for many of them being ground to a ſmooth ſurface, ſhew a grain that had a good deal of variety in it, and evidently different from holly, which is one ſmooth uniform grain. Becauſe ſome ſpecimens, which are found upon the land, and dry parts of the ſhore, having been long expoſed to the

ſun, and thereby as it were, bleached to a whiteneſs, and uniformity of appearance, not unlike holly, the opinion ſeems univerſally to have prevailed, that all the ſpecimens are holly: You will ſee ſufficient reaſon to deny that many of them have ever been holly; and that a few of the white and light kind have been holly, need not at preſent be diſputed; becauſe perhaps, ſome ſpecimens of that kind with wood continuous, may be found hereafter, which will determine the matter: Hitherto no ſuch ſpecimen has occurred to the Inquirer.

We are under a neceſſity to ſuppoſe this lapideſcent wood, any of thoſe kinds of wood, which grow naturally near the lake, or of thoſe kinds which are found in plenty, in the bogs adjoining to the lake. Becauſe it is reaſonable to ſuppoſe, this petrefied wood was depoſited in its beds of petrification, before the formation of bogs, and even the lake itſelf; or the growth of theſe trees which are found in the neighbourhood. Trees that are allowed to grow, and are afterwards felled, muſt fall in ſuch a manner, as to allow ſome intermediate ſpace between them; and ſuppoſing them immediately covered with clay, that clay will form partitions between tree and tree. But here is a bed of wood of four feet thick, of conſiderable extent, lying ſo compacted together, that no viſible interſtice appears, and no heterogene matter with it, but water, and a few of the transformed bodies from wood to ſtone, and a little of the Lac Lunæ, already mentioned, p. 98.

Trees found in neighbouring bogs are commonly found ſingle, and burnt (o) at the thick end, which helps to prove two things, both the felling them by fire, and not an ax; and alſo the modern production of

(o) There was indeed found in this pit at Ahaneſs, one piece of combuſtible wood about ſix pound weight, partly deſcribed Number CCLX. Lect. 3. which had in it, a great number of ſmall pieces of matter like charcoal, evidently diſtinct from the reſt of the woody matter intermixt with it. Theſe lumps of charcoal were all ſmall, none exceeding the ſize of a cork for a pint bottle, and ſome of that ſhape; when the piece had lain in the houſe ſome months, and being lifted in order to be put in the fire for ordinary uſe, it was taken notice of, and the charcoal fragments appeared remarkably black and ſhining; the incompaſſing matter being of a dirty black, or rather brown colour. This charcoal crumbled eaſily between the fingers, and became a fine black powder, diſcolouring the ſkin; it would inſtantly take fire when thrown upon the blaze of a candle, and being burnt, did not emit a fragrant fume, like the brown matter incompaſſing it, nor indeed ſo much of it, as the more firm wood, in the ſame bed of matter.

It

of the bogs which now cover them. The felling of trees in this manner, was a haſty method both of the Danes and Engliſh, to hinder the native Iriſh from ſheltring themſelves, in their woody mariſh grounds. And trees felled with boughs and leaves, are very proper to ſtop the courſe of water; the Beavers in America know this very well, who always begin their Waers in this manner, and will at laſt finiſh a bank that ſhall be impenetrable to water. And they who are concerned here,

It may be more proper to aſk, ſince no marks of fire appeared in any of the groſs blocks, how came theſe hither.

Although no groſs timber has been yet thrown up out of this bed, with marks of fire, yet ſome may hereafter be thrown up, when further ſearch ſhall be made. And if ſuch ſhould be found, they will not invalidate the argument here made uſe of to prove this bed of matter to be formed by the general deluge. Becauſe we are not to ſuppoſe, that timber was uſed for firing before the deluge: And if it was uſed for ſuch purpoſes, it ſhould ſeem probable, that wood reduced to charcoal, may ſometimes be found in ſtrata of matter formed in the deluge. Charcoal being leſs liable to putrefaction, than wood that has undergone the influence of fire. The particular cake of matter, which gave occaſion to this note, ſeems to have been two twigs or ſmall branches of a tree burnt to coal, and ſo intermixt with leaves preſſed into a denſe form, as ſeem at firſt to make one continuous body. And that leaves are capable of duration conſiſtent with this ſuppoſition, may be inferred from the Chemiſt's remark, (Boerhave El. Che. part 3. proceſs 2.) 'Who that had not ſeen it, could 'have believed, that diſtilling the tender leaves of roſemary for the ſpace of two days, ſhould 'have not deſtroyed them? Nay, but which is ſtill more ſurprizing, boil the ſmall fine 'flower as long as ever you pleaſe, and then carefully take it out, and view it either with 'your naked eye, or a microſcope, and you will find that its form is not in the leaſt altered.

Leaves which were to undergo no ſuch torture, may well be ſuppoſed to have laſted ſince the deluge, and the incumbent weight might ſo preſs them, as to give them the firmneſs of wood. For by artificial preſſure leaves of tobacco may be forced into a narrow compaſs, and a hard conſiſtence; and the ſheavings of leather being cloſely preſt, may become as rigid as a board. The manner of the breaking this lump of wood, with fragments of charcoal contained in it, gives good occaſion for this ſuppoſition. For it does not cleave like the reſt of the ſame ſtratum, lengthways; according to fibres, but into very ſhort, thin, irregular flakes. Probably more of this matter was thrown up at the ſame time, although none was taken notice of except this piece, being a piece accidentally obſerved to have ſomething ſingular, when it was in the hand in order to be thrown upon the fire. It is to the purpoſe to remark from Doctor Woodward, Cat. of Engliſh foſſils, part II. p. 19. A ſpecimen which he deſcribes thus.

'A piece of wood having manifeſt marks of its having been chared or burnt by the fire, be'fore it was buried in the earth; it is not unuſual to meet with wood thus burnt, re'poſited in the bowels of the earth. I have found it alſo in the peat marſhes of Cheſhire, 'and elſewhere; and G. F. de Oviedo obſerved charred wood in virgin earth, i. e. earth 'that had never been dug or diſturbed, at a conſiderable depth in the mines of Peru.

V. Purchas Pilgrims, lib. 5. c. 3. p. 971.

here, in the making and preſervation of banks for courſes of water to mills, are well acquainted with the uſe of the boughs of fir, which always having leaves, are excellent for the purpoſe.

The water of the mariſh grounds being thus ſtopped, or at leaſt delayed in its motion; the graſs and heath growing through it, and every year dying, has in a long courſe of time produced large tracts of land, called turf bog, replete with various kinds of timber; ſuch as red fir, oak, yew; all extremely uſeful, and other kinds of leſs value. Let any one examine a clod of turf of the red and ſoft kind, and he will find it almoſt a collection of withered graſs, and the ſtalks of heath; the black turf which is the moſt laſting of the two combuſtible matters, lies commonly deepeſt, and is no more than the moſt rotten part of the bog, which muſt be tempered like mortar, to make it capable of being wrought up into ſhape for human uſe in fuel. Large trees are for the moſt part found in theſe bogs, ſeparate from one another, and burnt at an end, and only covered with turf (*p*); but in the bed of petrifications, the timber is found preſſed into an heap, without any marks of fire, (except one ſmall ſpecimen) under and over a deep bed of clay.

We

(*p*) A ſenſible opinion concerning ſubterraneous trees is fully expreſt by Mr. Ray, and Mr. De La Pryme, in the following quotation.

The greateſt number of ſubterraneous trees were burnt or cut down by the labour of man, in the places where they now lie. In England there are found of them, in moſt of the great moraſſes, moſſes, fens, and bogs, in Somerſetſhire, Cheſhire, Lancaſhire, Weſtmoreland, Yorkſhire, Staffordſhire, Lincolnſhire, and other countries. The wood of them is uſually called moſs wood, and is as black as ebony.

Theſe trees I ſay, were anciently burnt or cut down by the labour of man, as Mr. De La Pryme does clearly make out, in a letter to Doctor Sloan, regiſtred in the philoſophical tranſactions Number 275. For many of theſe trees have been burnt, ſome quite through, ſome, all on one ſide; ſome have been chop'd and ſquared, ſome bored through, others half riven with great wooden wedges and ſtones in them, and broken ax heads.——And it is very obſervable, that upon the confines of the low country, between Burningham and Brumley in Lincolnſhire, are ſeveral great hills of looſe ſand, which as they are yearly worn and blown away with the wind, there are diſcovered under them, many roots of great firs, with the impreſſes of the ax as freſh upon them, as if they had been cut down but a few weeks; which I have ſeveral times with pleaſure taken notice of, as I rode that way.

You will aſk who felled thoſe trees? And for what reaſon did they fell them? Mr. De La Pryme tells us, and proves it by ſufficient authorities: That the Romans did it to take

theſe

We are at liberty therefore to call this petrefied wood, by any other name than that of fir, oak, yew, or any tree growing in Ireland. The agreeable ſmell of it ſhould incline us to think that it is cedar (*q*). It is

theſe ſhelters from the Britains, and to ſecure their conqueſts. For (ſaith he,) the ancient Roman writers and hiſtorians, frequently tell us, that when their Armies or Generals purſued the wild Britains, they always fled into the faſtneſſes of the miry woods, and low watry foreſts. Cæſar himſelf confeſſes the ſame, and ſays, that Caſſibalene and his Britains after their defeat paſſed the Thames, and fled into ſuch low moraſſes and woods, that there was no poſſibility of following them. We find alſo, that the ſtout nation of Silures did the ſame, when they were ſet upon by Oſtorius and Agricola. The like did Venutius, King of the Brigantes. And Herodian plainly tells us, that it was the cuſtom of the wild Britains, to keep in the fenny bogs, and thick marſhy woods; and when opportunity offered, to iſſue out, and fall upon the Romans; who were at length ſo plagued with them, that they were forced to iſſue out orders for the deſtroying, and cutting down all the woods and foreſts in Britain, eſpecially all that grew on low grounds and moraſſes. This order was executed, and they were accordingly cut down, as is evident in many writers, who tell us, that when Suetonius Paulinus conquered Angleſey, he cut down all the woods there. Galen the phyſician tells us, that the Romans kept their ſoldiers continually employed in cutting down of woods, draining marſhes and fens, and in paving of bogs. It is manifeſt alſo, they did not only do this themſelves, but impoſed the ſame heavy taſk upon the captive Britains. For Galgæcus in his ſpeech to his ſoldiers, tells them, that the Romans made ſlaves of them, and wore out their bodies in cutting down of woods, and in cleanſing of bogs, amidſt a thouſand ſtripes and indignities. But that which is moſt obſervable, is, what Dion Caſſius tells us, viz. That the Emperor Severus loſt 5000 of his men in a few years, in cutting down the woods, and cleanſing the fens and moraſſes of this nation. Mr. De La Pryme, adds much more of the famous levels of Hatfield chaſe, and the adjoining countries, which may be ſeen in the letter quoted before.

Moreover, not only the Romans have taken this courſe of cutting down the woods, for the reaſons alledged, but other great Generals alſo and conquerors of countries. So our Henry II, when he conquered Ireland, cut down all the woods that grew upon the low countries thereof, the better to ſecure his conqueſt and poſſeſſion of the ſame, to keep the country in a ſettled peace, and to diſarm the enemy, who truſting to ſuch advantages, are apt to rebel. ——The like did Edward I. when he conquered Wales.

Phiſico Theological Diſcourſes, from p. 232, by J. Ray.

The maſs of ſubterraneous wood, principally ſpoken of in theſe lectures, is evidently of another kind, and is fairly proved to be antediluvian. Although the remarks of theſe gentlemen be true concerning moſt timber raiſed out of mariſh ground; Yet ſince nothing ſimilar to this extraordinary ſtratum of ſubterraneous timber, came in the way of theſe diligent Inquirers into nature, the conſideration of this ſtratum is highly worth the Reader's attention.

(*q*) Gen. VI. 14. Make thee an arc of Gopher wood——————

The critics upon this paſſage remark ſeverally. See Pool his Synopſis.

GOPHER Vox alio loco non reperitur. Diverſimodo accipiunt.

I. Ge-

is certain that bog yew, which is like it in colour, is very unlike it in ſmell, and ſo is every other kind of timber, growing or raiſed out of the bogs in the neighbourhood.

One

I. Generaliter[f]. Neque enim unum genus aut debitâ copiâ ſuppeditari poterat ex unâ regione, aut ſatis commodé diverſis arcæ partibus, trabibus, tectis &c. adhiberetur[g].

De lignis bituminatis[h]. Confundit GOPHER cum COHHER[i]. Intelligi poſſunt arbores bitumin ſæ et reſinoſæ, quales pinus et cedrus[k]. Al. quadratis[l], ſcilicet ædificium[m] lævigatis Vulg. i. e. dolatis ac politis ad aptiorem et firmiorem campaginem[n]. Schol. ἐκ ξύλων ἀσήπτων i. e. imputribilibus[o].

II. Particulariter. Genus eſt ligni lævisſimi et ad fluitandum aptiſſimi, et quod nunquam pureſcit[p] Vel 1. cedrus. Ita patres aliqui[q] et Ch. Fermiſſima enim erat, et inopia abietis ad claſſes uſitata[r]. Et in Syria frequens erat, et longiſſimas dat tabulas et incorruptibilis eſt[s]. At cedri nomen EREZ tum Hebræis, tum Chaldæis, non GOPHER[t] vel 2 Pinus[u] quæ nautica dicitur Virgilio quaſi navibus aptiſſima. vel 3 Buxus[w]. At ſpiſſiſſima hæc eſt et graviſſima, nec fluitat in aquis[x]; vel 4. Abies[y] una ex quatuor ſpeciebus abietis[z] vel 5. cedrelate[a], quod accomodatius eſt Heb. voci quam cedrus[b]. vel 6. Terebinthus, Non tamen prorſus affirmo. Ea materie eſt lenta et fideli ad vetuſtatem, in Syria procera, quæ ſola ungi velit, meliorque oleo fiat, et ejus baccæ ſunt ſulphuroſæ, ſulphur autem Gophrith[c] dicitur. vel 7. Cupreſſus[d], tum ob firmitatem (nec teredines parit ut pote amara, hinc cupreſſinis tabulis inſcribuntur duratura) tum ob ſimilitudinem nominis[e]. Nam quid aliud cupar vel cuper, Græcis etiam Κυπάρισσος quam Gopher[f]. Nam mutationem G in C, PH in P, O in U nihil moror. Adde quod Crotenſes ex cupreſſo et domorum trabes et naves ſtruunt teſte Pet. Mart. Legat. Bab. l. 2 p. 338. Et materie rarâ eſt, ait Plinius, ideoque aquis ſupernatat. Teſtatiſſimæ cupreſſi perpetuitati competit quod refert Epiphanius Hæreſ. lib. 1. p. 23. *Arcæ reliquias ad ſuam ætatem viſendas perduraſſe.* Et hinc arbor illa Diti ſacra; et in arcas cupreſſinas mortuorum corpora condebant, quia in Diluvio erat, velut commune omnium hominum ſepulchrum[g], et διὰ τὸ ἄσηπτον εἶναι quia eſt expers putredinis, ait ſcholiaſtes ad lib. 2. Thucididis. Arborum maximè diuturna eſt cupreſſus, ex qua fabricatæ Epheſini templi valvæ per quatuor generationes incorruptæ durârant. Theophraſt. Hiſt. Plant. 5. 5. et Plin. 16. 40. Opera ex cupreſſo permanent ad æternam diutunitatem Vitruv. 2. 9. perpeputè nunquam moritura cupreſſus Mart. Ep. 6. 73.[h]. Vix tamen probat Fullerus hanc materiam ad navigia commodam &c. ait Bochartus. Qui idcirco illi ſuccurrit et probat, et Plut. Sympos l. 1. prob. 2. Neque naupegus primo collocat—pinum—cupreſſum et Veget. 4. 34.

Ex cupreſſo et pinu——precipué liburna contexitur. Et cupreſſos ad naves ſtruendas emi jubet Theodoricus Rex. Caſſod. Var. 5. Epiſt. 16. Inter arbores ναυπηγοῖς utiles cupreſſum nominat; Plato l. 4. Legum, et Diodorus l. 19. p. 702. His adde, quod in Aſſyria vel Babylonia (ubi primos homines habitaſſe conſtat ex Paradiſi deſcriptione, et montibus Ararat, ubi arca ſubſtitit) nulla eſt alia materies unde fabricantur naves. Hinc claſſis ingens quam Babylone conſtruxit Alexander conſtitit ex ſolo cupreſſo. Arrian in Alex. l. 7. p. 161. Strabo l. 16. p. p. 741.

[a] He. in v. [f] Sic. But. [g] But. [h] Hi. [i] D [k] Me. [l] S. [m] But. [n] Me. [o] D. [p] V. [q] Me, Ita. R. R. in M. et Ful, Onk. et Ion. D. V. [r] Ful. [s] Me. [t] Ful. miſc. [u] Q. in. V. M. O. [w] Ar. [x] Ful. [y] V. [z] M. [a] I T. [b] Ful. [c] Ca. [d] Ful. B P. [e] Ful. [f] Ful. [g] Ful ib. [h] B P. 1. 4.

The

One might be inclined to call it alder, if the accounts of that tree mentioned below (*r*) be true. But although alder is ſaid to be very durable under ground, for a reaſon aſſigned by Scaliger; yet this tree is not

The reaſon of giving this collection of opinions, concerning the wood of the Arc, is, that a fair argument may be drawn from all theſe almoſt united teſtimonies, that reſinous kinds of timber did abound in the world before the flood. And whereas the ſtrata of ligneous matter dug at 19 feet depth, under the ſurface of the earth, near Lough Neagh, and alſo under the water of the lake, are plainly formed by the deluge, of timber that grew before it. The reader is at liberty to chooſe, to which of all theſe reſinous kinds, he will reduce this foſſil wood: The reaſons for the Inquirer's opinion, are given; but he reckons it fair dealing to lay every thing before his reader, which may inable him to judge otherways if he thinks proper: Yet ſtill he thinks this compariſon of teſtimonies confirms his opinion. For the diſtinction between cedar and cyprus, is not eaſily made with accuracy in theſe parts of the world, where there is very little of either to be ſeen in a ſtate of growth, and not much in mechanical uſes. There are two trees of the former kind, now growing in the phyſic garden in Chelſea; and the Bermudas iſles which did once abound with it, have, it is ſaid very little of it at preſent: And cyprus is rather preſerved amongſt us in a ſhrubby form, to be uſed in medicine as ſavine, than in the form of foreſt trees.

(*r*) Ray ſays of it in one book

Materies olim fabricandis naviculis inſerviit.
Tunc almos primum fluvii ſenſere cavatas. Virg. Georg.

In ædificiorum fundamentis ſub terrâ poſita in ſolo humido permanet immortalis ad æternitatem, & ſuſtinet immania pondera ſtructuræ. Vide Vitruvium ubi agit de lignorum materie. Plin. l. 6. c. 37. Theophr. de cauſis lib. 3. c. 17. Cur alnus ſub aqua non putreſcat ſed duret, rationem reddit Scaliger, humidum habet communis naturæ, non enim aquam ſub aqua putrefiéri, quod nihil invehatur peregrini *. Venetiis magnis etiam ſumptibus alnus accerſiri ſolet ad facienda palatiorum et ædificiorum fundamenta: Palis etiam ex alno in terram adactis inædicfiatur pons ille famoſiſſimus unius arcus *de Rialto* dictus, canali magno impoſitus, et duas partes urbis connectens

Raii hiſtoria plantarum de alno.

* Does not the water contained under the thin part of the hollow ſhell of an oyſter, always grow fetid, that is, putrify, and is it not an art to open them without breaking that ſhell?

He ſays of it in another book.

Certum eſt et indubitatum palos ex alno infixos progreſſu temporis lapideſcere J. B. Verum, hoc neque alno propium, neque materiei ejus naturæ tribuendum cenſemus, ſed potius conditioni ſoli, aut liquori cuidam lapideſcenti qui in ejus poros ſe inſinuat. Nam nec ipſam ligni ſubſtantiam in lapidem mutatam eſſe certum eſt, nec alno ſemper aut in quocunque ſolo accidit ut lapideſcat, et alia præterea ligni genera in lapideam ſubſtantiam indurata vidimus, caſtaneam v. g. Aſpleiæ non procul ab Woburn in Comit Bedfordiæ.

not uſually found under ground in theſe places; tho' it be plenty in a growing ſtate in the neighbourhood, and is found alſo in turf bogs not very far from hence. But although it were found under ground in plenty here, how ſhall the fragrant ſmell belonging to the petrefied wood, be reconciled with the opinion of its being alder, which wants that ſmell: Some other wood ſhould therefore be ſuppoſed*.

Although we ſuppoſe this petrefying wood, brought hither by the deluge, and lying in one place ſince that time, the ſmell may be preſerved all that time, in ſuch a ſituation: For a cedar cheſt of ninety years uſe in the open air, has preſerved its power of exciting an agreeable ſmell *(s)*; and that ſmell may be more eaſily preſerved, in

Experimentum Kentmanni de Alno in lapidem indurando nobis non ſucceſſit*. V. C.G. in alno Cat. Plant. Angliæ J. Raii. Londini 1620. p. 14.

*LAPIDES, e Ligno corporati.

Elatites ex abiete.
Dryites, è quercu.
Phegites, à fago.
Clethrites, ex alno.

Hæc quidam præcedentia quatuor nomina imponi poſſunt, ut varietas ſit nota.

Iiſdem interdum innaſcuntur fluores candidi, ut in illa arbore, quæ in vallibus Iochimicis reperta eſt. Interdum Pyritæ flavi.

Ex alno etiam fit lapis artificioſe hoc modo. Imponitur lignum, quantæ velis magnitudinis, in libra illa amplâ ænea, in quibus lupulus coquitur, ad faciendam cereviſiam; cumque percoctus abundè lupulus eſt eximitur idem lignum, et arena vel glarea in ipſis celariis, obruitur per triennium; inde cum exemptum fuerit, duratum in lapidem apparet: E quo potiſſimum cotes fiunt, quibus ad ferramenta acuenda menſarii utuntur.

Ligna in Saxa.

Rami, folia, cortices, ligna, carbones, oſſa, conchæ, quæ in ſaxa corporata ſunt, ſucco lapideſcente, in fonte non procul a Francofurto ad Viadrum.

Rami, folia, cortices, ligna manicæ chirothecæ, et alia, immiſſa piſcinæ prope Schellenbergam arcem in Miſnia, in ſaxa corporantur.

Trabes molares mutatæ in ſaxa: Quæ trabes prope Torgam in Albi ſunt repertæ.

Ebenus ſubterraneus cum melanteria.

Lignum faginum in ſaxum corporatum, cujus dimidia pars adhuc lignum eſt.

Jo. Kentman Dreſdenſis medici Nomenclaturæ rerum foſſilium, quæ in Miſnia præcipuè, et in aliis quoque regionibus inveniuntur.

De omni foſſilium genere Conradus Geſnerus.

(s) The foſſil trees are uſually found without their roots, tho' theſe very roots, and even the leaves and fruit are often found in the ſame earth at ſome diſtance, many of the trees are broken off near the root; theſe lie horizontally, and have many of their larger branches alſo

in a place from whence predatory air is excluded. Fir preſerves its reſinous ſmell ſeveral centuries of years under ground, and why may not cedar and other kinds of woods, preſerve their ſmells in the ſame manner. The gums and ſpices, which are vegetable productions, uſed in the preparation of mummies, preſerve their ſmells in cloſe catacombs, perhaps thouſands of years.

If

alſo ſevered from them, and found at ſmall diſtances; the extremities of the boughs are uſually broken off, and where the roots lie in an irregular poſition, their extremities are uſually broken off alſo: But theſe more frequently ſtand in their natural poſture erect, and with their large roots running in their natural direction, down into the clay, or other firmer bottom of the bog, and not unfrequently the ſtumps of theſe appear above the ſurface, the trunks lying at ſome ſmall diſtances.

It is idle to imagine that theſe have been buried either at the creation, or the general deluge; at the firſt of thoſe times, the ſtrata muſt have been formed before trees were yet in being; and peat wood is far from being of Diluvian date, that much of it has been growing within theſe three or four hundred years, in the very places where it is now buried: In this ſtate, that is, little altered from their natural condition, it is, that we principally find the fruits and larger parts of trees.

What we find of them more altered, are ſometimes large and long branches of trees, ſometimes ſhorter, ſometimes ſmall fragments of branches, and moſt frequently ſhapeleſs pieces of wood.

The larger and longer branches, are uſually found bedded in the ſtrata of ſtone, and theſe are uſually more or leſs altered, into the nature of the ſtratum they lie in.

The ſhorter or ſmaller branches are found in vaſt variety, in the ſtrata of blue clay, of which they make tiles in the neighbourhood of London; theſe uſually carry the whole external reſemblance of what they once were; but nothing of the inner ſtructure, having all their pores ſo filled up with the matter of the vitrolic pyrites, as to ſeem pure maſſes of that matter; theſe fall to pieces on being expoſed to a moiſt air, and are what are principally uſed for the making of green vitriol or copperas.

The irregular maſſes or fragments of wood, are principally of oak, and are found among gravel, and in many other ſtrata; theſe are variouſly altered, by the inſinuation of cryſtalline, and ſtony particles, but ſtill preſerving the veins of wood, they make a beautiful figure when poliſhed.

Theſe according to the various matter that has filled their pores, aſſume various colours, and appearances of various foſſils that have filled them, ſome are perfectly white, and moderately hard, others of a browniſh black, or perfectly black and much harder; others of of a reddiſh black, others are of a yellowiſh, and others greyiſh, and others of a ferrugineous colour: They are of different weights and hardneſſes, according to the nature of the ſtony particles they contain. *The moſt ſingular of theſe that I have met with, are two in my own poſſeſſion, the one with its pores filled every where with a pure pellucid cryſtal, the other a black maſs, which was ſimple oak within this hundred years, having been put as a prop to a roof of one of the mines in the Hartz foreſt, yet now is ſo perfectly petrefied, as to ſtrike fire with ſteel.* This is much of the ſame kind with the famous foſſil wood of Lough

If it be alledged that this ſmell, is the effect of the petreſcent matter mixt with the wood. It may be anſwered, that if that was the caſe, the ſtony part of theſe mixt ſubſtances, would yield the ſtrongeſt ſmell; but it

Neagh, in Ireland, which the ingenious Mr. Simon has taken great pains to prove of recent petrification, and this a plain evidence of the poſſibility of that being the caſe. Mr. Simon has made many accurate experiments to prove this, and has favoured me with large quantities of the wood, ſome of which is wholly, ſome only a part petrefied.

In the ſpecimens I have from Germany, ſome have veins of ſparry, ſome of earthy, and ſome of matter reſembling that of the common pebbles; theſe ſometimes, tho' rarely, have the ſhape of parts of branches of trees, they more uſually look like broken pieces of boards, and are generally found capable of a high poliſh.

Many ſubſtances have, it is certain, been preſerved in the cabinets of the curious for petrefied wood, which have very little right to that name: But where the fibrous and fiſtular texture of the ſtriæ, and the veſtiges of the Utriculi and Tracheæ or air veſſels, are yet remaining, the bark yet perfect, and the ſeveral circles yet viſible, which denoted the ſeveral years growth of the tree, none can deny ſuch ſubſtances to be real foſſil woods, and ſuch as theſe are often covered with efflorences of ſpar or other minerals, and frequently contain veins of pure ſpar or cryſtal. General natural Hiſtory, by John Hill, p. 639.

This ſort of wood is found moſt commonly in ſtrata of gravel or ſand, and ſometimes in ſtone, clay, or marl; all that I obſerved of it was altered, and increaſed in hardneſs and weight, either by inſinuations of ſtony and mineral matter, during the time that theſe and other bodies were ſuſtained, among the diſſolved ſtony and mineral matter, in the water of the deluge, by a total ſolution of the vegetable ſubſtance, and a ſucceſſion of ſtony mineral or metallic in its ſtead.

What hath been imagined by ſome, that this alteration was made ſince, by petrefying water, is without reaſon or any good obſervation to countenance it. Even that which is found in lakes, and in rivulets, was originally lodged in the earth at the bottom of them, and *petrefied before it was repoſited there.*

In particular, a more accurate inquiry and trials have been ſhewn, than what was formerly pretended of the petrefying power of *Lough Oneagh*, in *Ireland*, which is not true: For the water makes no ſuch alteration upon any wood that is put into it. The petrefying wood that is brought thence, being of that which was orignally lodged in the earth at the bottom of the lake. I inſtance in the wood brought out of this lake, becauſe it is inſiſted upon, and more notice has been taken of it, than of any other.

Catalogue of Foſſils, by J. Woodward, Part II. p. 19.

The two foregoing quotations from Inquirers into natural phænomena, contain two opinions: I. *The petrefied wood that is brought thence* (from Lake Oneagh) *being of that which was originally lodged in the earth, at the bottom of the Lake.* And that this inquiry has been of an early date, appears from what he ſays afterwards.

II. Mr. Hill is of opinion, the petrefied wood of Lough Neagh of which he has many ſpecimens, which were of the collection of the Author of this book, tho' ſent by the Gentleman mentioned, is of a recent production, at leaſt leſs than one hundred years. The Reader may give a judgment of theſe two opinions, from what is ſaid in the courſe of theſe lectures.

it is quite otherwiſe, the ſtony part yields it faintly, the wood ſtrongly, eſpecially when it is burning, which ſhews that it is of the intimate nature of the wood, and can not be ſeparated from it without a total deſtruction.

The manner of this timber being brought from other parts of the world, to be interred here in the general deluge, is no difficulty to thoſe who have any faith at all, or capacity to reaſon from general ſimilar effects, to a common cauſe. Suppoſing therefore this heap of wood lying under ſtrata of clay, to the depth of nineteen feet. This preſſure continuing from the time of the deluge, through ſo many centuries of years, produced a flattening of many of the trees, and thereby a cloſe union of them, with the boughs alſo and leaves, which being broken off, are ſqueezed together into hard ſolid cakes, that at firſt appear to be firm wood, and are forced in between the trunks ſo as to make a ſtratum of a denſe matter, without any viſible interſtice; for the wonderful effects of ſuch preſſure, have been already demonſtrated, and if a ſceptical perſon ſhould alledge that an earthquake, which is capable of making prodigious changes in the ſurface and ſtrata of the earth, might throw an heap of timber in this bed, he need only be told, that this part of the world has not ever been ſenſible of ſuch dreadful phænomena, as the choques and tearing, and tranſplanting of theſe parts of the globe by earthquakes: But alſo he may be told, that the agitation of the waters in the deluge, might occaſion ſuch colliſion of the trees againſt each other, as not only to tear off their boughs, but even to ſplit and break the ſurface of the trunks, ſo as to render them more cloſely united in one maſs.

If it were proper to encourage this diſpoſition in mankind, to form hypotheſes upon all things, there is here a fair occaſion to conjecture, that the origin of all jet and pit coal is wood; that is, ſtrata of this kind of wood formed by the deluge, imbibing particular ſteams of the earth, become a moſt excellent and durable fuel for fire. It would be going out of the way to inlarge upon this, and therefore the proper ſubject muſt be reſumed *.

The queſtion concerning the time neceſſary for petrification, ſhould now be diſcuſſed.

As

* Whoever will examine the whole collection of foſſils, part of which is only publiſhed in this book, will ſee good foundation for this opinion, conſidering alſo the immenſe bodies of coal of various kinds, in the neighbourhood of theſe petrifications.

As to the time of petrification, we may take all or moſt of what has paſt ſince the general deluge. But if the whole time be taken, it may be asked, why is not the whole maſs petrefyed as well as particular parts. In anſwer to this it ſhould be obſerved, that to produce any effect, there muſt be an aptitude in the ſubject matter, as well as the cauſe: Perhaps the pores of ſome of this wood, are too cloſe to admit the petreſcent effluvia of the earth, perhaps too wide to retain it; or, ſince the ſubtlety of effluvia is ſuch ſometimes, as to penetrate the moſt compact and denſe matter, which is elſewhere mentioned in theſe lectures, it may be more conſonant to true philoſophy, to ſay, that there is a congruity between ſome pieces of wood, and this effluvia; and incongruity in reſpect to others: For there are many inſtances in the material world of this kind.

By congruity is here meant a proper proportion, as to bulk, ſhape, motion and pores, between any matter ſubtilized, producing phænomena along with other matter. Therefore it is poſſible, that as much of the petrification as is now effected, was made ſo very ſoon after the wood was depoſited in the beds of petrification, and if it continue there ſome thouſand years more, perhaps no alteration would be produced. This is proper to be obſerved, in compliance with the old and conſtant account, of the petrifications of this lake. If ſeven years, which is the general opinion at preſent, or three times ſeven, be the time for petrifications produced in the water of the lake; why ſhould not the ſame cauſe produce its effects in the ſame time beyond the influence of the water?

It may be anſwered, that the water may help to produce this effect, ſooner than the effluvia of the earth alone without it: For water has been already conſidered in this reſpect, and the ſame reaſoning need not be repeated.

Theſe foſſil petrifications may have been effected in ſeven years, twenty years, or a thouſand, or more or leſs, than any of theſe for ought, any man can ſay, with foundation of reaſon; and yet the old teſtimony of the phænomena of petrifications in the lake, in a limited time may be true. For this teſtimony has almoſt every circumſtance of credit to recommend it; its antiquity and univerſality are of weight in this reſpect, to which ſhould be added, its not having any ſuperſtitious notions annext to it. For although theſe petrifications have been much admired, they were never worſhipped;

worſhipped; nor are they kept as venerable pieces of ſuperſtition, like the Cranbourn cryſtals mentioned already, which are preſerved as religious charms, by thoſe who live near the ſpring, where they are ſaid to grow in one night's time: An opinion, univerſal and old, and without ſuperſtition, ſhould not be deſpiſed.

The effluvia of the earth, therefore may produce petrifications in ſeven years, with the inſtrumentality of water; and upon a particular wood, holly, which was once very plenty about this lake, and much uſed by fiſhermen to fix their nets.

It is not eaſy now to get a ſpecimen of holly converted to ſtone, with any wood continuous; becauſe all this kind of timber is totally deſtroyed, and alſo becauſe the fiſhing now practiſed, is not ſo much by fixt, as draught nets. At Toom being the common diſcharge of the lake, where ſome thouſand barrels of Eels are taken every year, there is occaſion to drive a great number of piles, but none of theſe are holly, and tho' ſome are fixt twenty years, they are not any way petrefied: Yet a man who farms part of the fiſhery, and has been employed near thirty years, declares he put down one pile of holly on purpoſe to make an experiment, and that the lower part was turned to ſtone within ſeven years: He does not give his account as accurately, as a perſon converſant in philoſophic matters would do, yet he is honeſt by character, and can certainly diſtinguiſh wood from ſtone. If experiments have been made to the ſame purpoſe, by others of undoubted reputation, which have failed, this ſhould not explode the belief the fact*. For it is not eaſy to tell, how many concomitant circumſtances are neceſſary, beſides the principal cauſe, to wit, the terreſtrial effluvia impregnated with ſtony particles; the holly perhaps ought to be of a certain age, or dimenſions of growth; there is perhaps a particular depth of water required. There are perhaps particular places where the effluvia aſcends freely, others where it is totally interrupted, by a ſtratum of denſe compact matter; there may be a quieſcence required in the water: But all parts of the lake are not convenient for that; the experiment may be tried in a place very proper in all theſe reſpects, and yet one ſtorm may move the waters with ſuch agitation, as to overwhelm that place with ſand, and defeat the deſign of the inquiry, ſince no diſcovery can ever be made of the effect.

* It ſhould be remarked, that the Lough having increaſed greatly, perhaps within one century or two, experiments now made, are far from the places where theſe phænomena were common formerly.

effect. Theſe are reaſons why experiments may not ſucceed, and yet the fact may be according to the old and univerſal tradition.

It may be urged, if terreſtrial effluvia occaſions theſe phænomena, and the production of them be ſo early as this reaſoning implies: why are not ſpecimens found in the land in greater plenty, and why have not ſome of thoſe ſpecimens wood continuous? The anſwer may be, that as many of them as lie near the ſurface of the earth, are ſubject to the influence of the external atmoſphere, which is predatory, and deſtroys vegetable bodies, when the final period of vegetation is arrived at, that is, when the vegetable is come to its compleat condition of growth. The ſurface of the earth being often turned, they are liable to ſuch colliſions, as muſt ſeparate the ligneous parts from the ſtone. For although ſpecimens of this kind might have been very common, when theſe lands firſt admitted a plough, they may be ſcarce now. Ploughing in this place is not earlier than the reign of Queen Elizabeth. For Moryſon *(a)* in his hiſtory obſerves, that they ſcarce knew what bread

(a) A Bohemian Baron complained, who having ſeen the Courts of England and Scotland, would needs out of his curioſity return through Ireland, in the heat of the rebellion, and having letters from the King of Scots, to the Iriſh Lords then in rebellion, firſt landed among them, in the furtheſt North, where for eight days ſpace he found no bread, not ſo much as a cake of oats, till he came to ſit with the Earl of Tir-Oen, and after obtaining the Lord Deputy's Paſs to come into our army, related this their want of bread to us for a miracle, who nothing wondered thereat. Moryſon's Hiſtory of Ireland, Dub. Vol. II. p. 374.

To this authority it may be objected, that Ireland was once much more populous than it was in the Earl of Tir-Oen's time, as the Archbiſhop of Dublin, KING, relates.

'It is certain Ireland has been better inhabited than it is at preſent. Mountains that are 'now covered with bogs, have formerly been ploughed: For when you dig five or ſix foot 'deep, you diſcover a proper ſoil for vegetables, and find it ploughed into ridges and furrows. This is obſerved in the wild mountains between Ardmagh and Dundalk, where the 'redoubt is built, and likewiſe on the mountains of Altmore; the ſame as I am informed 'has been obſerved in the Country of Londonderry and Donnegal; a plough was found in 'a very deep bog in the latter, and a hedge with wattles ſtanding, under a bog that was 'five or ſix feet deep above it. I have ſeen the ſtump of a large tree in a bog ten feet deep, 'at Caſtle-Forbes; the trunk had been burnt, and ſome of the cynders and aſhes lay ſtill on 'the ſtump. I have ſeen likewiſe, large old oaks grow on land, that had the remains of 'ridges and furrows; And I am told that on the top of an high mountain in the north, 'there are yet remaining the ſtreets and footſteps of a large town; and in truth there are few 'places, but either viſible, or when the bog is removed, ſhew marks of the plough, which 'ſure muſt prove that the Country was anciently well inhabited.

It

bread was in this part of the kingdom; although it might have been common to turn up ſurprizing ſpecimens of theſe mixt ſubſtances, for ſome time after, yet now, after the frequent ploughing of the land, it may be almoſt impoſſible.

The terreſtrial effluvia conſidered as the cauſe of petrification, is thus cleared from the objections; and if it accounts for the turning of wood into ſtone, it may alſo eaſily account for the turning of wood into iron; for the internal air of the earth is as capable of bearing the particles of one as the other, ſince by propoſitions in the firſt lecture, all matter is capable of ſuch comminution, as to be made to ſwim in a ſpecifically lighter fluid. The internal air therefore, will always be impregnated with particles of ſuch matter, as the ſtrata have, which it pervades; but in the deſcription of the lake, in Lecture IV. it was particularly remarked, that there was a great deal of iron ore on the ſhores of the lake, where it waſhes the County of Derry; and to that may be added, that ſtrata of that ore reach to the mountain Slew Galen, and perhaps ſome diſtance under the lake.

It is likely that the Danes firſt, and then the Engliſh deſtroyed the people, and the old woods ſeem to thoſe who pretend to judge, to be about three or four hundred years ſtanding, which was near the time that Courcey and the Britiſh ſubdued the North of Ireland, and it is likely made havock of the people, that remained, after the Danes were beat out of Ireland. See manner of manuring lands, &c. in the Natural Hiſtory of Ireland.

Although this remark may be allowed to be juſt, yet it does not prove, that the lands immediately incompaſſing the lough were ploughed. For having been extremely woody, a plough could not be uſed until they were cleared of wood, which it is well known was not done till within a century paſt: The high lands, or mountains, being formerly perhaps bare of wood, and the low lands overgrown, the former were ploughed by the very old inhabitants, the marks of which induſtry, may be diſcovered in ſome mountains. But when the low lands were cleared of two impediments, water and trees, the plough was uſed in them to better advantage; becauſe they were more fertile.

Inducti terræ bonitate, volebant
Pandere agros pingues & paſcua reddere rura. Lucret. li. 5.
* * * * * * * * *
Inque magis dies in montem ſucedere ſylvas
Cogebant, infraque locum concedere cultis,

The opinion which the ingenious and laborious Schuitzer mentions, tho' not with approbation, Iter alpinum, Lug. Bat. 1723. is probable and to the purpoſe. Orta eſt quæſtio de prima vallium & montium inhabitatione—Prætendunt Montes, horumque apices initio fuiſſe ab hominibus occupatos, quandoquidem nullum ſit dubium, fuiſſe inferiora montium latera, & valles ipſas montibus interiectas ſylvas denſas & horridas, quæ ſucceſſu temporis & ſeculorum debuerunt a montivagis dejici, eradicari, & in prata virentia, agroſque fæcundos commutari, ſenſim adeo ad habitationem aptæ reddi.

Near the lake there is now an iron foundery, and the ore is principally raiſed between that and the mountain Slew Galen, which is within about ten miles of the lake. Here therefore is a ſtratum of metalline matter, to impregnate the terreſtrial effluvia, and conſequently in this place the pores of wood may be filled with this matter, as well as with that of ſtone. For the pores even of growing vegetables, admit metalline particles, which coaleſce with the vegetable ſubſtance (*b*).

But if any one is ſurprized that the parts of matter, which are made ſo ſmall, as to be boyed up by ſo light a fluid as air, can become ſuch denſe and weighty matter as iron and ſtone, let ſuch a one conſider, what extreme hardneſs air itſelf is capable of acquiring, even ſo as to become as hard as marble, if the particles are brought to contiguity; and experiments upon various ſorts of bodies, vegetable, calcarious, and metalline, prove that air intangled with other matter, help to conſtitute the natural bodies, as appears from the ſixth propoſition of the ſecond Lecture, as well as thoſe comminuted to a great degree help to conſtitute air. For air is in reality a fluid aggregate of exceeding ſmall particles, of all ſorts of denſe and heavy bodies; and may therefore be ſpecifically heavier than any portion of comminuted matter, except gold, which is the heavieſt; they may therefore all be allowed to be ſupported by the fluid air, except gold, by the known principles of Hydroſtatics; and when the motion of the air is conſidered, which it always has more or leſs, comminuted gold may eaſily be allowed to float in it; for motion renders every kind of fluid capable of ſupporting bodies ſpecifically heavier.

Thus are the three laſt queſtions anſwered, concerning theſe petrifications, as to the kind of wood, the time of petrification, and the mixture of metalline matter.

WE

(*b*) In monte Juntzen obſervantur ligna fagina aliis quæ alibi creſcant duriora, graviora & varie intorta, nodoſa, incolæ ipſi arceſſunt hanc lignorum quaſi ferream duritiem, ſucco nutritio particulis ipſis Chalybis impregnato, & veluti ferruminato, cui philoſophus haud difficilem præbebit aſſenſum, ſi ligna norit per macerationes in aquis Chalybeatis Martiatis duriora reddi & ferro pæne invicta. Conſtat præterea ex plantarum analyſi vegetabilibus omnibus ineſſe particulas ferreas quæ proin fuere ex terrâ cum ſucco nutritio elevatæ: Elevabuntur autem plures, ſi terræ viſcera venâ ferri ſint referta.

Schuitzer Iter Alpinum Lug. Bat. 1643. p. 160.

WE are now to ſpeak concerning the medicinal quality of the Lake.

THE Sanative quality of the Lake, in reſpect to diſorders in the ſurface of the body, not being fairly traced higher than the reign of King Charles II. there is not ſo old a teſtimony for this quality, as for its petrifications. The place moſt remarkable for this, is, a bay called Fiſher's bay, in the County of Tir-Oen, as is related at large, Lecture IV. And perhaps the reaſon which gives that place the preference, is the ſmoothneſs of the ſhore, conſiſting of a ſoft ſand, giving no pain to naked feet, together with an eaſy declivity which allows the timorous to wade in, without any danger of a ſudden plunge.

If the obſervations of ſome perſons, who have bathed in that part of the lake, called Fiſher's bay, be true, that the water or ſand at the bottom in particular places, is warm, it is a probable argument, that there may be ſprings there. The Hungarian Governour, (de admirandis Hungariæ aquis) obſerves, that in the river Vagus near Galgotium, hot water riſes in the bottom. Neque in ripâ tantum eruuntur calidæ ſed etiam intra amnem, ſi fundum ejus pedibus ſuffodias, calent autem immodicè &c. But this part of the lough having been frozen intirely, in the year 1739-40, deſtroys the probability of this; for it having been cuſtomary during the froſt, to paſs from one county to another, upon the ſurface of the frozen lake, paſſengers muſt have obſerved places unfrozen, if there were any; but the Inquirer never heard of ſuch from any perſons of credit.

Laying aſide therefore the conſideration of ſprings, if the water of the lake be not altogether of one homogene kind, at conſiderable diſtances from the mouths of the great rivers which form it, as partaking more or leſs of ſubterraneous effluvias, in different places: There is a preſumption, that the water of that ſide of the lake where the iron *(c)* ore abounds, is the moſt ſanative part of it; at leaſt for ſome particular

(c) As from what has been ſaid, it appears, that the ſubterraneal effluvia may cauſe diſtempers, ſo it may not be amiſs to take notice, that poſſibly in ſome meaſure, mineral effluvia may prevent diſtempers. For it is obſerved, that ſeveral parts of Scotland are free from agues, and that very hot and large regions in the Eaſt Indies, are rarely troubled with the plague,

diſorders. For ſuppoſe different ſtrata of matter, to lie under different parts of the lake; the terreſtrial effluvia ſhall be impregnated in different parts of the lake, with different kinds of matter: In the County of Tir-Oen ſide of the lake, where there is a vaſt body of coal, it ſhall be impregnated with the bitumen, and other parts of coal *(d)*; in the County of Derry ſide, where there is a great body of iron ore, the terreſtrial effluvia, muſt abound with ſulphur, and ſuch kinds of matter as conſtitute iron, which of all the metals is found to be moſt medicinal: And for this I produce the authority of a great chemiſt and phyſician. Boerhave ſays, ‘ bodies that owe their origin to the ſame earth, are eaſily

plague, nor is it leſs remarkable, that in Ireland, the air is impregnated with ſuch ſort of emanations, as prevent the generation of any venemous creatures; to which I ſhall add the following inſtance from Beguinus.

Dignum admiratione eſt, quod quamvis in vicinià Hydriæ comitatus Gloricenſis, ubi reperitur copioſà ☿, ſingulis fere annis Lues peſtifera graſſatur, illa tamen ſemper immunis ab hac manere ſoleat, idque viri providæ ætatis ſe obſervaſſe, et a majoribus ſuis accepiſſe mihi ſancte confirmarunt. Boyle abridged by Boulton, Vol. II. p. 284.

(d) The beds of coal with which this Country abounds, in the neighbourhood of a navigable lake, which has alſo a navigable communication with the ſea, by means of a canal, are of extraordinary conſequence to the kingdom. The works are now in a fair way of anſwering the noble intention of the public, in laying out above fifty thouſand pounds ſterl. in order to open a free paſſage for ſupplies of fewel, to a great part of the kingdom, but eſpecially to the capital of it. This paſſage (concerning which ſee the map) being a beautiful canal from the ſea port of Newry, to the navigable part of the Ban River, being thirteen miles; and nine miles of the river, together with part of the lake, the Black Water river, and another canal from thence to the pits; will not only inable the kingdom to receive coals at eight or nine ſhillings a tun at diſtant places: But alſo the linen manufacture is hereby extremely benefitted, upon account of convenient water carriage for kelp, and all other weighty materials, neceſſary for that valuable branch of trade. But the deſign of this book being philoſophical, rather than mercantile, a particular account of theſe things, may more properly belong to anorher treatiſe mentioned already. Yet one circumſtance ſhall not be omitted, that whereas inceſſant rains during the ſummer of the year 1744, almoſt totally deſtroyed the fruits of the Northern parts of this kingdom, and the merchants were obliged to import, above one hundred and fifty thouſand pounds worth of corn, for the ſupport of the people, and the horſes for want of food, were many of them dead, and the reſt too weak for labour; this canal was of excellent uſe in contributing to convey the corn, to the inhabitants of five counties, in the neighbourhood of the lake: ſo that moderately ſpeaking, the lives of fifty thouſand people were ſaved thereby, which is ſo great an emolument ariſing from this work, tho' not the original intention of it, that if no other ſhould ever ariſe from it, the public is already amply rewarded for the expence: But it is alſo in a fair way of anſwering every intention of it, to which all imaginable ſucceſs is wiſhed. See a dialogue concerning ſome things of importance to Ireland, publiſhed this year in Dublin.

'eaſily tranſmuted into one another: Iron which of all the metals ſeems 'to come neareſt to the earth of animals and vegetables, muſt be al-'lowed likewiſe to come neareſt to animals and vegetables in nature, 'and ſeems as if it might in ſome meaſure be diſſolved in them: And 'hence it yields a noble, and very ſafe remedy for diſeaſes of the human 'body, whilſt the reſt of the metals act with more violence (*e*).'

The terreſtrial effluvia abounding with the ſulphur of the iron ore, is detained in the water, which thereby is rendered very ſanative. If this detention of the effluvia, be thought to be ſaid without foundation, let it be conſidered, that in the common experiment of ſmoaking tobacco, if a contrivance be uſed to make the ſmoak paſs through the water, that water ſhall become a ſtrong emetic; this can be owing to nothing elſe, than the detention of the ſmoak in the body of the water: In the ſame manner may the terreſtrial effluvia, be detained in the water of the lake, and that of different kinds, in different places. Hence may the waters be found more ſanative in one place, than another, and ſanative in reſpect to ſome particular diſorders in one place, and in reſpect to other diſorders in others. But the ſhores being very rough in ſome parts, and ſmooth in others; it is very likely the latter will always have the greateſt reputation in this reſpect; people being apt to prefer thoſe things, which are attended with leaſt pain. To what has been laid down concerning theſe terreſtrial effluvias, it may be objected, that if the water of the lake was impregnated with heterogene matter, in this manner; the chemical analyſis of the water would diſcover it: But the analyſis of this water, diſcovers nothing ſingular.

In anſwer to this, it ſhould be conſidered, that the very nature of an effluvia, implies ſomething very fugacious, and therefore not eaſily brought under the torture of chemiſtry, eſpecially when experiments are tried upon the water, at the diſtance of the capital city from the lake; being more than ſixty Iriſh miles, from the neareſt part.

It ſhould alſo be conſidered, that the mixture even of metalline matter, when reduced to an effluvia, with water, does not neceſſarily increaſe the ſpecifical weight, and for this the chemiſts might be quoted, particularly

(*e*) To this may be added, the ſentiment of the ingenious James Keil. Tentamina medico phyſica 'ex dictis petenda eſt ratio cur ex Chalybe intenſiorem, quam ex cæteris 'metallis, ſanguis calorem concipit, quod ſcil, majori elaſticitate donatur, quâ etiam ad vaſa 'obſtructa aperienda gravioribus metallis præſtat.

larly Mr. Boyle; if the propoſitions in the firſt lecture, concerning the prodigious increaſe of ſurface in the diviſion of bodies, did not almoſt oblige us to infer it. For hence it follows, that metals comminuted ſo as to ſwim in fluids, muſt be reduced to ſuch parts as contain under their ſurfaces, ſo little matter in reſpect to them, that whatever difference there may be, between their ſpecific gravities and very light fluids, may eaſily be overcome by a gentle motion, or tenacity of the fluid; in which caſe there is an equilibrium, and that mixt fluid may be of the ſame ſpecific weight, with the original homogene fluid. For this comminuted matter may be ſo ſmall in quantity, as to mix with the fluid, and yet upon experiment not appear to add to the ſpecific gravity, conſidering how many allowances muſt neceſſarily be made, for inaccuracy in moſt caſes concerning natural phænomena *(f)*. Mr. Boyle remarks ſome waters with mineral particles, are lighter than waters not impregnated with them upon account of volatility.

If the ſtony or metalline particles, be ſuppoſed to be ſtill further divided, the ſurfaces are ſtill larger than the proportion of the leſſening matter, in which caſe they will ſwim on the top; and if after an agitation of the fluid, which mixes them with it; a portion of the fluid be weighed, it may ſeem ſpecifically lighter. If the particles are ſuppoſed larger, than the degree of ſmallneſs neceſſary to make them ſwim, they will ſink, and if after agitation a portion of the fluid be weighed, it ſhould appear ſpecifically heavier.

In regard to the waters of the Lake, it may be difficult to ſay which of all theſe may be the caſe: For if the terreſtrial effluvia ſhould bring ſtony and mineral particles with it, of equal gravity with water, they would continue in it, and a chemical analyſis might determine ſomething concerning them: If the particles were heavier, they would ſubſide in all calms, when the water is almoſt quieſcent, and form a very extraordinary ſediment, capable of being obſerved; but ſince neither of theſe is the caſe, they are light and fugacious, and are perhaps conſtantly paſſing through the water into the upper atmoſphere; which may alſo contribute

(f) 'I found by by weighing hydroſtatically water impregnated with iron, that 'it was not much heavier than common water.' Boyl on Gems, and in the ſame tract. 'Sometimes mineral particles may be ſo ſpirituous, as not to increaſe their ſpecific gravity; 'for I have ſeen ferrugineous water, which, tho' ſtrongly impregnated, was little heavier 'than common water.'

bute to the wholſomneſs of the air. For whereas all freſh water (g) vapours are known to be more pernicious to human conſtitutions, than ſea vapour, yet the air about this vaſt lake, is under no diſcredit in that reſpect (h). But whatever the caſe may be, it is ſufficient at preſent, that the probability of a terreſtrial effluvia is eſtabliſhed, that the fact of petrification is put beyond all doubt, that the place is accurately deſcribed, where more ſpecimens may be had by future Inquirers, to whom all ſucceſs imaginable is wiſhed.

As to the facts, as they now ſtand, and have been honeſtly laid before you, they can not by any future inquiry be contradicted; for the facts can never be altered; you are at liberty, therefore Gentlemen, either to allow the reaſoning upon them to be fair, or, at your leiſure to ſubſtitute in the place of it, any other ſyſtem which may ſeem more ſuitable to the ſubject.

(g) Yet the great Francis Bacon, ſays, (Hiſtory of Life and Death) what ſeems ſtrange, the ſalt marſhes which are at certain ſeaſons, overflowed with ſea water, prove more unwholſom than the freſh.

(h) Qui corporis poros perpetuo permeat aer, multas neceſſario ſecum invehit aqueas particulas &c. Ja. Keil. Diſquiſitio ſecunda.

The air of Ireland being extremely moiſt, probably the intermixture of Chalybeate particles with it, in the neighbourhood of this lake, may prevent its ill effects.

Keil's remark upon bad air, is, Nullam non aeris mutationem corpora noſtra afficere poſſe abunde patet, cumque minima naturæ corpuſcula maximâ virtute polleant, quo ſubtiliore e terra aut aſtris exhalatione aer inficiatur eò gravius nos plecti. But if this chalybeate effluvia be wholſom, the contrary effect muſt be produced. This ſeems to be the caſe of the air about Lough Neagh.

Advertiſement.

HERE ſhould have followed a lecture concerning the preſent form of the earth, with the antediluvian, and paradiſaical forms; This lecture is prepared, with a diagram, explaining many things concerning the Deluge. For in as much as the beds of petrifications, which make a great part of the ſubject of this book, are proved to be formed in the change of things, in the great Æra of natural appearances, the general flood in the time of Noah, a fair account of the effects of that inundation, would properly belong to this place. But it is too large for inſertion, and were it not ſo, the Readers being of the claſs of the FAITHFUL in religion, as well as the ſkilful in philoſophy, it is hoped, that it will not be deemed neceſſary.



APPENDIX

CONCERNING THE

EFFLUX and INFLUX,

OF THE

WATER

OF

LOUGH *NEAGH*.

THE papers in the philoſophical tranſactions, copies of which are given below (*i*), (*k*) ſuch kinds of computations not being eaſily retained in the memory, are the foundation of the following account of Lough Neagh.

 They

(*i*) An experiment of the evaporation of water, by Mr. Edm. Halley, n. 189. 366. Lowthorp's Abridgment of the Philoſophical Tranſactions, Vol. II. p. 108.

We took a pan of water (ſalted to the ſame degree as is common for ſea water, by the ſolution of about a fortieth part of ſalt) about four inches deep, and ſeven inches, nine tenths diameter, in which we placed a Thermometer, and by means of a pan of coals, we brought the water to the ſame degree of heat, which is obſerved to be that of the air in our hotteſt ſummers; the Thermometer nicely ſhewing it. This done, we affixed the pan of water, with the Thermometer in it, to one end of the beam of the ſcales, and exactly counterpoiſed it with weights in the other ſcale, and by the application or removal of the pan of coals, we found it very eaſy to maintain the water in the ſame degree of heat preciſely.

Doing

They who have ſurveyed this Lake, obſerve, that there is only one viſible diſcharge of the water of the lake at Toom, and that there are eight pretty conſiderable rivers beſides rivulets, conſtantly conveying water into it: And that the diſcharge ſeems vaſtly diſproportionate and inferior in quantity, to the ſum of the inlets. Hence ſome have been induced

Doing thus we found the weight of the water ſenſibly to decreaſe, and at the end of two hours we obſerved, that there wanted half an ounce troy, all but ſeven grains, or two hundred and thirty three grains of water, which in that time had gone off in vapour; tho' one could hardly perceive it ſmoak, and the water was not ſenſibly warm. This quantity in ſo ſhort a time ſeemed conſiderable, being little leſs than ſix ounces in twenty four hours, from ſo ſmall a ſurface as a circle of eight inches diameter. To reduce this experiment to an exact calculus, and determine the thickneſs of the ſkin of water that had evaporated, I aſſume the experiment alledged by Doctor *Edward Bernard*, to have been made in the *Oxford Society*, viz. that the cube foot *Engliſh* of *water*, weighs exactly ſeventy ſix pounds troy: This divided by 1728, the number of inches in a foot will give $253\frac{1}{3}$ grains, or half ounce $13\frac{1}{3}$ grains for the weight of a cube inch of water. Now the area of the circle, whoſe diameter is $7\frac{9}{10}$ inches, is 49 foot ſquare inches, by which dividing the quantity of water evaporated viz. $\frac{3}{38}$ of an inch, the quote $\frac{3}{1862}$ or $\frac{1}{53}$, ſhews that the thickneſs of the water, evaporated, was the 53d part of an inch: But we will ſuppoſe it only the 60th part, for the facility of calculation.

To eſtimate the quantity of water ariſing in vapour out of the ſea; I think I ought to conſider it only for the time the ſun is up, for that the dews return at night, if not more vapours, than are then emitted: And in ſummer the days being longer than twelve hours, this exceſs is balanced by the weaker action of the ſun, eſpecially when riſing before the water be warmed: So that if I allow $\frac{1}{10}$ of an inch of the ſurface of the ſea, to be raiſed *per diem* in vapours, it may not be an improbable conjecture.

Upon this ſuppoſition, every 10 ſquare inches of the ſurface of the water, yields in vapour *per diem*, a cube inch of water; and each ſquare foot, half a wine pint; every ſpace of 4 feet ſquare, a gallon; a mile ſquare 6914 tuns; and if the Mediterranean be eſtimated at 40 degrees long, and 4 broad, allowances being made for the places where it is broader, by thoſe where it is narrower, (and I am ſure I gueſs at the leaſt) there will be 160 ſquare degrees of ſea; and conſequently the whole Mediterranean muſt loſe in vapour, in a ſummer's day, at leaſt 5280 millions of tuns. And this quantity of vapour, tho' very great, is as little as can be concluded from the experiment produced: And yet there remains another cauſe which can not be reduced to the rule, I mean the *winds*, whereby the ſurface of the water is licked up, ſomewhat faſter than it exhales by the heat of the ſun, being well known to thoſe that have conſidered thoſe drying *winds* which blow ſometimes.

The Mediterranean receives theſe conſiderable rivers; the *Iberus*, the *Rhone*, the *Tiber*, the *Po*, the *Danube*, the *Neiſter*, the *Boriſthenes*, the *Tanais*, and the *Nile*, all the reſt being of no great note, and their quantity of water inconſiderable. We will ſuppoſe each of theſe nine rivers, to bring down ten times as much water as the river Thames, not that any

duced to ſuppoſe a ſubterraneous paſſage, to account for the diſcharge of a ſurplus maſs of water, which otherwiſe ſhould riſe to a very conſiderable height. But in as much as there appears not any ſign of ſuch paſſage to navigators upon the lake, and which could not be concealed from them, (was there any ſuch thing) the influx of water at ſuch a paſ-

any of them is ſo great in reality, but to comprehend with them all the ſmall rivulets that fall into the ſea, which otherwiſe I know not how to allow for.

To calculate the water of the Thames, I aſſume that at *Kingſton's bridge*, where the flood never reaches, and the water always runs down; the breadth of the channel is 100 yards, and its depth 3, it being reduced to an equality (in both which ſuppoſitions, I am ſure I take the moſt.) Hence the *Profile* of the water in this place, is 300 ſquare yards: This multiplied by 48 miles (which I allow the water to run in 24 hours, at 2 miles an hour, or 84480 yards, gives 25344000 cubic yards of water to be evacuated every day, that is, 20300000 tuns *per diem*: And I doubt not but in the exceſs of my meaſures of the channel of the river: I have more than ſufficient allowance for the waters of the *Brent*, the *Wandel*, the *Lea*, and *Darwent*, which are all worth notice, that fall into the Thames below Kingſton.

(*k*) The evaporation of water in a cloſe room at Greſham College 1693, by Mr. Edm. Halley, n. 212. p. 183. in the Abridgment of Phil. Tranſ. by Lowthorp. Vol. II. p. 110.

In order to explain the circulation of vapours experimentally, I cauſed an experiment of the quantity of vapours ariſing ſimply from the warmth of the water, without being expoſed either to ſun or wind, to be made in Greſham College, which was performed with great care and accuracy, by Mr. Hunt operator to the *Royal Society*. Having added into one ſum the evaporations of the whole year, I find, that from a ſurface as near as could be meaſured of eight ſquare inches, there did evaporate during the year 16292 grains of water, which is 64 cubic inches of water, and that divided by 8 inches, the area of the water's ſurface, ſhews that the depth of water evaporated in one year, amounts to 8 inches. But this is much too little to anſwer to the experiments of the *French*, who found that it rained 19 inches water in a year at *Paris*; or thoſe of Mr. Townley, who by a long continued ſeries of obſervations, has ſufficiently proved, that in Lancaſhire at the foot of the hills, there falls above 40 inches of water in the year's time. Whence it is very obvious, that the *ſun* and *wind* are much more the cauſes of evaporation, than any internal heat or agitation of the water.

The ſame obſervations do likewiſe ſhew an odd quality in the vapours of water, which is that of adhering to the ſurface that exhaled them, which they cloath as it were with a fleece of vaporous air, which once inveſting it, the vapour riſes afterwards in much leſs quantity: Which was ſhewed by the ſmall quantity of water, that was loſt in 24 hours time, when the air was very ſtill, in proportion to what went away in a ſtrong gale, although the experiments were made in a place, as cloſe from the wind as could be well contrived. For which reaſon had wind come freely, it would have carried at leaſt three times as much as we found, without the aſſiſtance of the ſun, which might perhaps have doubled it.

a paſſage in a lake every where ſhallow, neceſſarily occaſioning a whirlpool dangerous to navigation; it ſeems reaſonable to account for the height of the water, not ordinarily exceeding a particular known altitude, in the following manner.

Before the autumnal ſeaſon of the year, when the rains begin to ſoften the earth, and ſwell the rivers, the water diſcharged at Toom, is very inconſiderable, ſo as not to afford a depth greater than that, which may reach to a ſhoe buckle, or the knee of a perſon wading; and once it happened, that a perſon taking the opportunity of an in-blowing wind, walked over dry ſhod (*a*). But at the ſame time the influx of water is inconſiderable.

The upper Ban, which may be ſuppoſed the greateſt of the eight rivers, for it eminently gives a name to all the reſt, when they flow in one channel to the ſea, being called the lower Ban, has been frequently obſerved to have ſcarce any current water in it, immediately before the falling of the great rains; and upon this account is not reckoned by ſome writers, amongſt the rivers of Ireland, but is conſidered as a large brook: The definition of a brook being, a water flowing in a known channel, in the form of a flood, owing to a ſudden fall of rain in the neighbouring mountains, whence it takes its riſe. The Bleachers upon this

By the ſame experiment it likewiſe appears, that the evaporations made in *May*, *June*, *July*, and *Auguſt*, (which are nearly equal) are about three times as much as what evaporated in the 4 months of *November*, *December*, *January* and *February*, which are likewiſe nearly equal, *March* and *April* anſwering nearly to *September* and *October*.

The fleece of vapours in ſtill weather hanging on the ſurface of the water, is the occaſion of very ſtrange appearances, by the refraction of the ſaid vapours differing from the common air, whereby every thing appears raiſed, as houſes like ſteeples, ſhips as on land above the water, and the land raiſed, and as it were lifted from the ſea, and many times ſeeming to overhang.

And this may give a tolerable account of what I have heard, of ſeeing the cattle in the Iſle of *Dogs*, at high water time from Greenwich, when none are to be ſeen at low water, (which ſome have endeavoured to explain, by ſuppoſing the Iſle of *Dogs* to have been lifted by the tide coming under it.)

But the vaporous effluvia of water, having a greater degree of refraction, than the common air, may ſuffice to bring theſe beams down to the eye, which when the water is retired, and the vapours ſubſided with it, paſſes and conſequently the objects ſeen at the one time, may be conceived to diſappear at the other.

(*a*) This is a broad bank near the Eel waers, over which when the water has paſſed, it flows in a much narrower channel, being five and twenty feet deep in part of it, and flowing with rapidity. The channel contains two eel waers, one of which is rendered uſeleſs, by a great quantity of ſand thrown into it by the water in ſtorms.

this brook, for ſuch it may be called, although it be a conſiderable flux of water a great part of the year, are well acquainted with the phænomena of it, and do frequently in a fair ſun-ſhining day, hear the roaring of a torrent at a mile's diſtance, the miſchief of which they can not always prevent, but muſt ſometimes ſuffer the damage of having fifty pieces of linen waſhed off the green, which, although often found, being ſtopt by rocks and buſhes, are often torn. The courſe of this brook from the fountain head in the mountains near Rathfryland, to the lough in a direct line, is not above four or five and twenty miles; and ſhowers in mountains being frequent, when there is no appearance of them in the vallies, moſt rivers or brooks whoſe courſes are ſhort, upon this account are ſubject to torrents. The Poet ſays,

Ruſticus expectat dum deſſuat amnis, at ille
Labitur & labetur in omne volubilis ævum.

Ruſticus here does not ſignify what is vulgarly thought a countryman or peaſant in general, but particularly a mountaineer, who being well acquainted with the nature of torrents in the mountains, which may riſe and fall, in leſs than the ſpace of an hour, thinks when he deſcends to the vallies, and ſeeing a regular flowing river, that it is of the ſame nature of a montaneous torrent, and that in a little time he may walk over dry. But in this he is deceived; For *labetur in omne ævum.*

At the concluſion therefore of the ſummer, ſuppoſing it a dry ſeaſon, there is very little water flowing into the lough, ſince the other ſeven brooks, or rivers are ſingly inferior to the Ban in quantity of water. When the rains fall in abundance, and the brooks or rivers ſwell above their banks, and continue ſo during five months, and ſometimes more, there is a prodigious quantity of water, in ſo much that the diſcharge at Toom being vaſtly leſs, the water of the lough uſually riſes from ſix to nine feet perpendicularly, and ſpreads over about ten thouſand acres of land, more than it does when it is at the loweſt, which is about 10c000 acres. In the ſpring of the year when the eight rivers are reduced to rivulets, by the drying winds in March and May; the influx of water is much leſs than the efflux; the diſcharge at Toom is all that

time

time very conſiderable, and the lough is every day ſubſiding, and the flat grounds about it becoming uſeful for bleaching, paſture, and meadow.

The diſcharge of this great body of water, may be eſtimated in the following manner.

The lake is about 60 miles round, which may be reduced to the form of a ſquare of fifteen miles a ſide, for the ſake of computation, although being nearly circular, it does in that form contain a much larger area of ſurface, than in the ſame number of miles in a ſquare from a known property of the circle, being the moſt capacious of figures: Multiply 1760 yards in an Engliſh mile, by 15 the ſide of the ſquare, and then that product into itſelf, and you have 696960000 ſquare yards in the ſurface of the lake, and ſuppoſing the lake to be at a medium ſix feet deep all through, computing the height of the water from the ſurface, when it is loweſt in ſummer, to the ſurface when it is higheſt in winter, although the difference for the moſt part is much greater, except on the lands which are only flooded in winter: Yet at a medium ſuppoſing the increaſed height ſix feet, or two yards all over, and multiplying the number of ſuperficial ſquare yards by 2, you have 1393920000 cubic yards of water; and ſuppoſing the channel at Toom, the common viſible diſcharge of all the water out of the lough, to be only 100 yards broad, and its depth three yards, it being reduced to an equality, although in the deepeſt part it be five and twenty feet (*a*), hence the profile of water in this place is 300 ſquare yards. This multiplied by 48 miles (or 84480 yards) which the water may be allowed to run in 24 hours at 2 miles in an hour, gives 25344000 cubic yards of water diſcharged in 04 hours, which dividing 139392000, the cubic yards of water expreſſing the whole maſs of increaſe in the winter, you have a quotient of 55 exactly, expreſſing the number of days in which the whole maſs of additional water, may be diſcharged; provided there was no influx at the ſame time; but there is a very conſiderable one at the beginning of the computation, and it leſſens afterwards, till at laſt in the drieſt time of the year, it becomes very little: The diſcharge of this influx of water may be accounted for another way, being carried up in vapour, and may be computed in the following manner.

That

(*a*) See note (*a*) page 154.

That one tenth of an inch of the water of the lake, is raiſed per diem in vapours, may not be an improbable conjecture from the conditions mentioned in the foregoing paper.

Upon this ſuppoſition every 10 ſquare inches of the ſurface of the water, yield in vapour per diem a cubic inch of water, every ſpace of 4 feet ſquare a gallon, and a mile ſquare 6914 tuns. And if the lake be eſtimated as above, as a ſquare whoſe ſide is 15 miles, there will be 125 ſquare miles of water, which multiplying 6914 gives a product 864250 tuns of water, raiſed daily in vapour during the drying months. This may reaſonably be ſuppoſed, to be a ballance for the influx of eight rivers into the lake, which being ſubject to montaneous floods are not at other times very abundant in water. It ſhould be conſidered alſo, that the diſcharge at Toom, upon account of in blowing, or out blowing winds, may flow with a different degree of rapidity and depth of water: For it has happened twice in one century, that the river Rhone at Geneva, where it paſſes from the lake of that name, has been ſtopped by a ſtorm, where its uſual depth was five and twenty feet, in ſo much that people went down into its channel, and took up fiſh, medals and other things.

Lough Neagh is often interrupted or accelarated in its courſe, in a manner ſimilar to this; beſides, it ſometimes rolls the gravel and throws up a barrier againſt itſelf, choaking its own channel, and ſooner or later another wind perhaps removes that (*a*). Hence it happens, that the times of the lakes higheſt and loweſt waters, can not preciſely be brought to rules: For they happen ſooner or later in the year, according to the agency of all theſe cauſes, eſpecially ſince the cauſes which raiſe theſe vapours from the lake, do alſo at the ſame time diminiſh the rivers during part of the ſpring and ſummer (*b*): And in the beginning of the computation

(*a*) In the narrow channel where the profile of water is computed page 156. There are two eel waers, one of which is rendered uſeleſs by a great quantity of ſand, which was thrown in by the water in a ſtorm, making it too ſhallow; for the fiſh run in deep water.

(*b*) If any exceptions are taken to this reaſoning upon a freſh water lake, drawn from that already applied to a ſalt ſea; it ſhould be obſerved, that the difference in weight between ſalt water and freſh, is not conſiderable, and that the ſun exhales little or no ſalt.

The Inquirer has obſerved at the Giant's Cauſey, in the North of Ireland, where the ſea at high water waſhes the tops of the pillars, the ſun did evaporate the water, between tide and tide in a hot day, and left in the top of each concave pillar about a ſmall ſpoonful of good ſalt. Hence ſhould be inferred, that little or no ſalt is exhaled by the ſun from the ſea.

Mr.

computation when the rivers are full, the lake has by ten thouſand acres a larger ſurface for the ſun and winds to act upon, and conſequently does then really yield a greater quantity of vapours cæteris paribus. If any perſon knowing the courſe of the waters of the lake, ſhould obſerve, that at the high rock called the fall at Colerain, which is the only paſſage for the waters of the lake to the ſea, there be an appearance in the dry months, of much leſs water, than paſſes at Toom, being the beginning of the channel wherein the water is conveyed to the ſea; let it be conſidered, that about a mile from Toom, the water ſpreads again into a ſmall lake of about four miles diameter, as may be ſeen in ſome of the maps prefixt to Lecture IV. particularly that of Speed, from which a great quantity of vapour muſt ariſe, and diminiſh the quantity of water that otherwiſe would flow to Colerain; add to this the courſe of the water for twenty miles, before it reaches the fall of Colerain, during which ſpace of motion the winds and ſun continue to diminiſh it.

Mr. Boyl indeed ſays, I have obſerved, that even the lighteſt waters will yield a ſmall quantity of common ſalt. Boyl abridged by Boulton, Vol. I. p. 296.

N. B. The Inquirer having made remarks upon the wind, weather and barometer, for a year and a half, in Lurgan, near Lough Neagh, having fixt a weather vane upon a ſteeple for that purpoſe, to obſerve the direction of the wind, and another on his houſe, to denote the force by means of that and ſome machinery within; and having noted down the remarks for every day in diſtinct columns, he thought to have inſerted them here; but the Barometer and one weather vane meeting with accidents, which hindered him to compleat two years obſervations as he intended; (thoſe of the time mentioned not being ſufficient for his deſign,) he chuſes inſtead of publiſhing his own imperfect obſervations, to lay before the reader a ſpecimen, of what may be done this way, in imitation of the Gentlemen at Edinburgh, amongſt whom there ſeems to be a ſpirit for promoting natural knowledge. If ſuch obſervations were made with accuracy, in ſeveral parts of this kingdom, many uſeful things would attend the knowledge thence redounding. The form of the tables for this purpoſe, uſed by them and the Inquirer, tho' not exactly the ſame, might in a great meaſure anſwer the ſame purpoſe.

Meteorological Regiſter.

January.

	Hour		Barom.	Therm.	Wind		Weather	Quantity of rain.
Day	a. m.	p. m.	In Day	In Day	Direction	Force	In Day	Day and Night
1	10	4	29	8 7	S. W.	0	Cloudy	
2	9	6	27	8 6	S. E.	2		

Ours fall ſhort of the plan of theſe Gentlemen, in as much as they had a column for the Hygroſcope. See Medical Eſſays, Edinburgh, Vol. I MDCCXLVII.

Such regiſters for every County in the kingdom, and for different parts of the ſame County, where there are mountains or lakes would be extremely uſeful, with regard to health, gardening, farming, &c.—beſides many things of information to philoſophers and ſpeculatiſts.

GEMS;

OR, THE

Phyſico-Mechanical Lecture:

BEING THE

PRODUCTIONS of LOUGH NEAGH,
Of the more precious Kind,

Applied to USE by

MECHANIC ARTS.

TOGETHER WITH

The PHYSICAL CAUSE of GEMS.

LECTURE VI.

EXOD. xxviii.

And they ſhall make the EPHOD—And thou ſhalt take two Onix ſtones, and grave on them the names of the children of *Iſrael*. And thou ſhalt make the Breaſt-plate of JUDGMENT—and thou ſhalt ſet it in ſettings of ſtones—the firſt row ſhall be a Sardius, a Topas, and a Carbuncle: And the ſecond row ſhall be an Emerald, a Sapphire, and a Diamond: And the third row a Ligure, an Agate, and an Amethyſt: And the fourth row, a Beryl, and an Onyx, and a Jaſper: They ſhall be ſet in Gold in their incloſings.

AN ADDRESS TO THE LADIES.

LADIES,

HAVING acknowledged the favour of the Gentlemen in a former meeting, a prefatory addreſs is juſtly due to you in this. It is with pleaſure the Philoſopher ſpeaks, when the Ladies are to approve. And what ſhould he ſpeak but praiſe, when the works of Nature, which may always teach, and can never corrupt, are deemed by you not unworthy of your ſtudy? The Emerald and Topaz are not died in vain, when they improve your minds, as well as adorn your bodies.

Beauty is to you, what gold is to the Diamond or Ruby in the Jewel, only the ſetting; and if a little art is beſtowed to render that ſetting not unſuitable to its plaee, it is not that alone which engages the Curious.

Knowledge does as well become one ſex as the other, and if by a kind of Turkiſh policy, it be concealed from yours, that is a misfortune. Yet ſuch a diſpoſition as by this day's meeting you ſhew, muſt upon many occaſions have opened your minds to information, which renders you truly valuable in that, for which you ought principally to value yourſelves.

They who have travelled lateſt into foreign parts can aſſure you, that a lady of Bologna has advanced ſo far in the ſtudy of natural phæ-

nomena, as to deliver Lectures upon them, in the elegance of the Roman language, hitherto thought the province of men †.

But ſince your humility will not let you take upon you the office of teachers, your judgment directs you to do the next kind things, to hear, and to approve.

Your patience therefore is humbly deſired in one, with hopes of obtaining favour in the other.

THUS much was ſaid upon the occaſion of reading the Lectures in manuſcript, one of which many Ladies attended, having earneſtly requeſted to be admitted, and were thoſe of rank and judgment; and who were pleaſed to expreſs their approbation of the information they received.

The Inquirer is of opinion, that he ſaid no more in this Addreſs than what was civil and juſt; but in as much as he has been called upon, either to retract or defend his ſentiments of the Ladies in the circumſtance of Literature; he chuſes rather to defend his opinion than to give up the honour of any part of the human race, and in reality the great intereſt of the whole.

The foundation of his opinion, that Women ſhould be taught, and made in a better degree acquainted with Arts and Sciences than is cuſtomary, ſhall be expreſſed in few words. It is plain that Women have the management of the male part of the ſpecies as well as the female, for the few years of the beginning of life: It is well known that the impreſſions made upon the human mind, even in the firſt years, are of conſiderable importance to the welfare of the human race: It is alſo well known that by the death of husbands, Women often get the government of

† This Lady has taken a Doctor's degree in the univerſity, and is called Doctor Tereſa: She is married and is a mother of children. To this may be added an account lately ſent from Stockholm. The Counteſs Senatrix of Ekeblad, was declared a member of the Royal Society, for the encouragement of Arts and Sciences, in conſideration of the many valuable experiments, that Lady has made in the art of Oeconomy.——The Prince has granted her his royal patent for the publication of thoſe experiments. To theſe accounts may be added a more recent fact. By a letter from Milan we are informed, that Madam Catane Agneſi, native of that city, celebrated for her profound learning and knowledge in ſeveral Arts and Sciences, particularly in the Mathematics, had been ſome time ſince named to fill a vacant Profeſſorſhip. This Lady has ſince wrote to the Pope, to thank him for the honour he has done her, for having made choice of her to fill that place; to which his Holineſs anſwered: 'That this was not only an honour to her, but much more 'to the Univerſity, which has the glory to poſſeſs a Lady, who by her profound learning 'ſurpaſſes all thoſe of her time.'

of large families of children, and that the opinion of the Mother muſt in a great meaſure determine their courſe of Education. To aſk, after being thoroughly ſenſible of theſe things, whether it is proper to give more knowledge to the Female part of human ſociety? is to aſk a queſtion too idle for a ſtudied anſwer: But it may be aſked in return, whether Solomon's deſcription of a good Woman be a mere religious *Ens Rationis*, or a deſcription of what may and ſhould often come to paſs? If it be the latter, it will not be eaſy to reconcile all that ſkill of manufactures and prudence of behaviour, with the opinion of thoſe perſons to whom this Reply is addreſt. " Who can find a virtuous Wo-
" man: for her price is far above RUBIES. The heart of her Husband
" doth ſafely truſt her, ſo that he ſhall have no need of ſpoyl. She
" will do him good and not evil all the days of her life. She ſeeketh
" wool and flax, and worketh willingly with her hands. She is like
" the merchants ſhips, ſhe bringeth her food from afar. She riſeth
" alſo while it is yet night, and giveth meat to her houſhold, and a
" portion to her maidens She conſidereth a field and buyeth it: with
" the fruit of her hands ſhe planteth a vineyard. She giveth her loyns
" with ſtrength and ſtrengtheneth her arms. She perceiveth that her
" merchandize is good; her candle goeth not out by night. She layeth
" her hands to the ſpindle, and her hands hold the diſtaff. She ſtretch-
" eth out her hand to the poor, yea ſhe reacheth forth her hand to the
" needy. She is not afraid of the ſnow for her houſhold: for all her
" houſhold are clothed with ſcarlet. She maketh herſelf coverings of
" tapeſtry, her clothing is ſilk and purple. Her husband is known in
" the gates (*a*), when he ſitteth with the elders of the land. She ma-
" keth fine linen and ſelleth it, and delivereth girdles unto the mer-
" chant. Strength and honour are her clothing, and ſhe ſhall rejoyce
" in time to come. SHE OPENETH HER MOUTH WITH WISDOM,
" AND IN HER TONGUE IS THE LAW OF KINDNESS. She looketh
" well to the ways of her houſhold, and eateth not the bread of idle-
" neſs. Her children ariſe up and call her bleſſed; her husband alſo and

(*a*) The Courts of judicature were held in the Gates of cities: the making and execution of Laws with judgment and integrity, is the moſt honourable office in a civil ſtate; and the approbation of conduct upon a fair ſcrutiny before upright Judges is the higheſt praiſe.

" and he praiſeth her. Many daughters have done virtuouſly, and thou " excelleſt them all. Favour is deceitful and beauty is vain; but a " Woman that feareth the Lord, ſhe ſhall be praiſed. Give her of the " fruit of her hands, and let her own works praiſe her in the gates."

This charming character is founded upon a great degree of uſeful knowledge; and if the ſubject of the following Lecture be not expreſt in it, perhaps it is not excluded from it. Although Solomon does not recommend the ſtudy of this part of Natural Philoſophy, concerning GEMS, to Women; yet he chuſes them as precious parts of Natural Productions, to which to compare a valuable Woman; Her price is far above RUBIES.

There is no occaſion to diſpute critically here, which of the Gems he really means: For it is not any one kind of Gem, but a ſubſtitution of a leſs for a more general kind; and the meaning is all kinds of Gems held in eſtimation by mankind: If they were not worth the contemplation of Women, they would not be worth a choice in *Solomon*'s judgment upon which to found a compariſon in ſo extraordinary a caſe; eſpecially ſince God alſo made choice of them for civil and religious purpoſes.

LECTURE

Fronting Lect: 6. Plate 7.

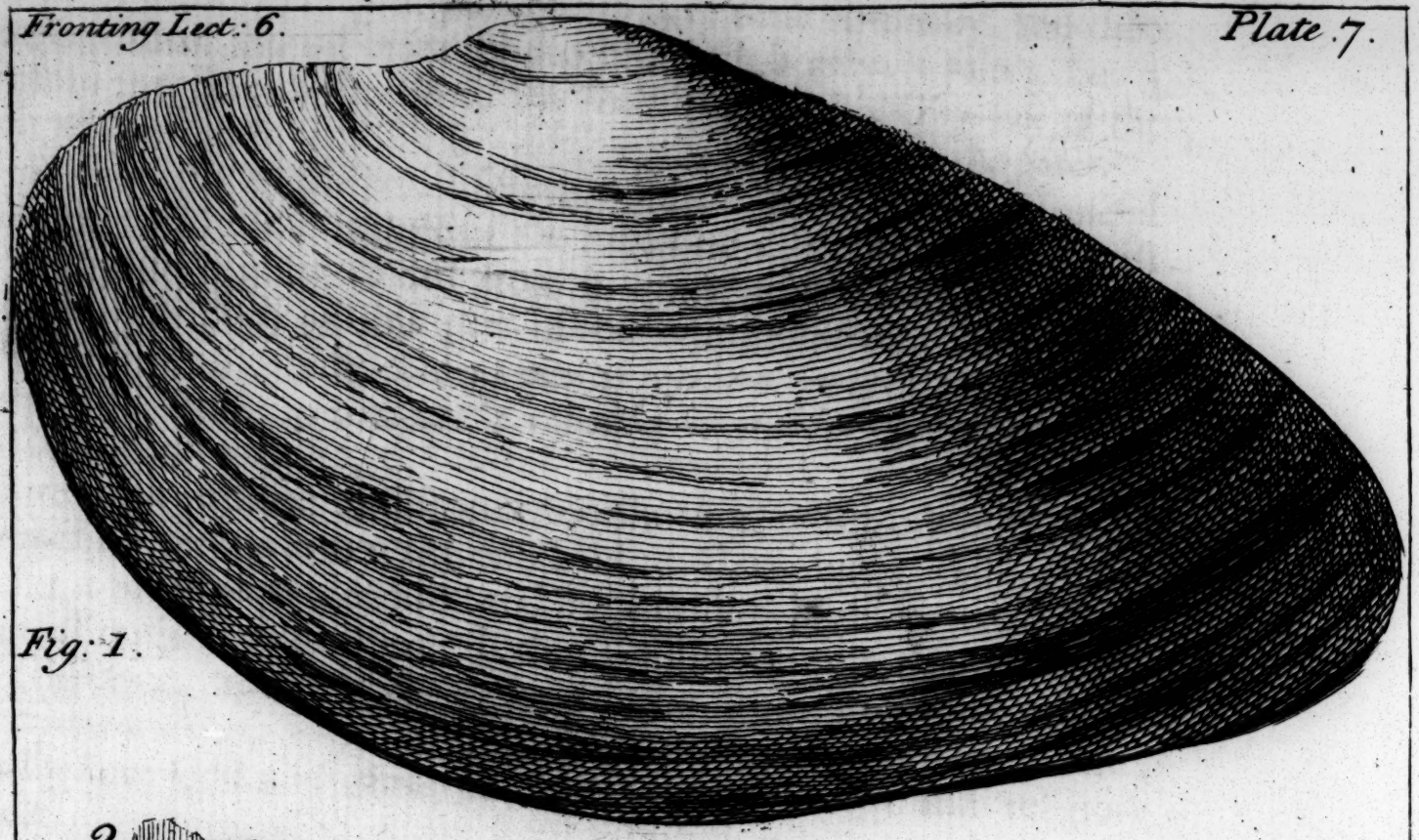
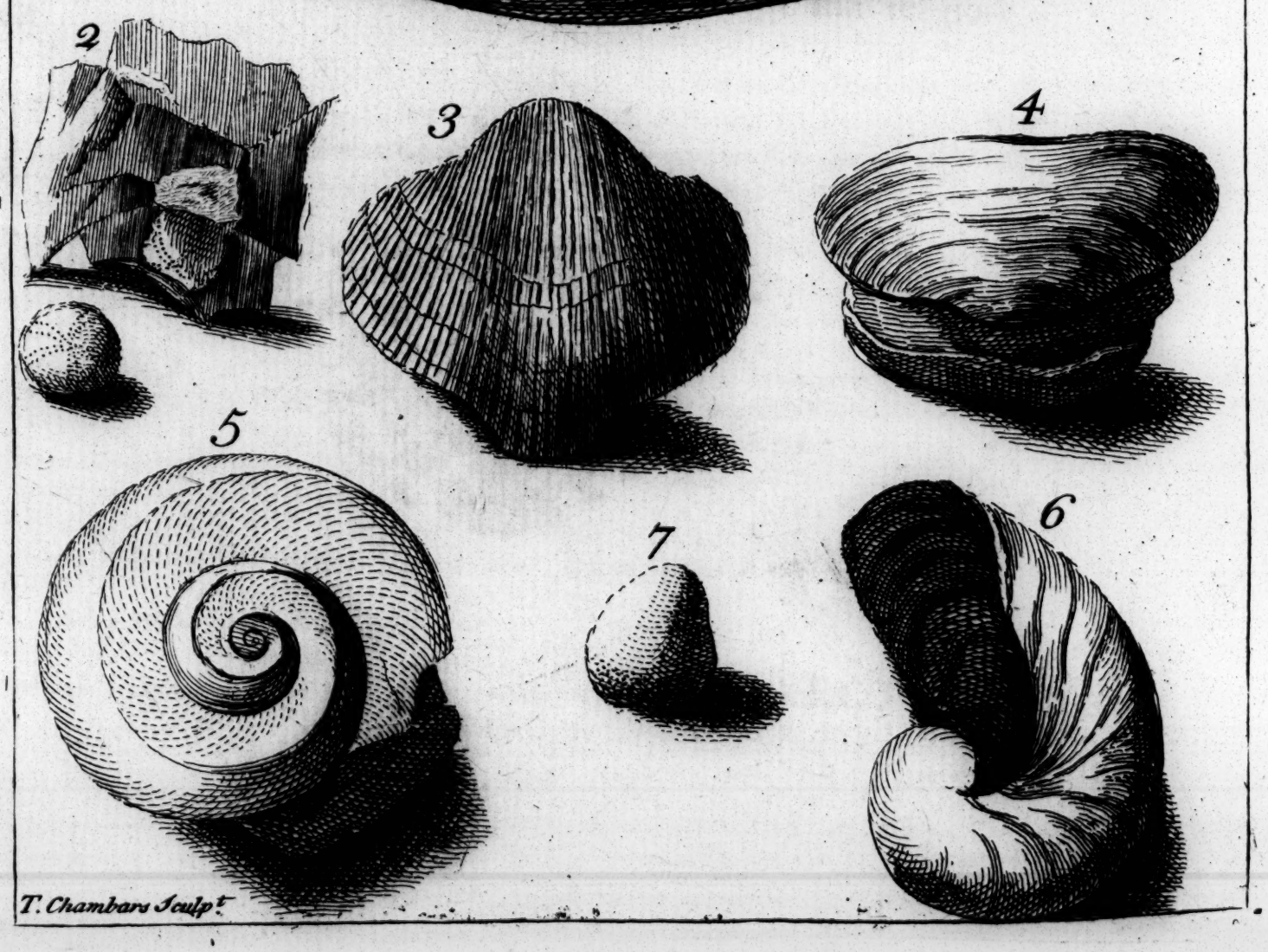


Fig: 1.



T. Chambars Sculp.t

LECTURE VI.

THE indiſpoſition to believe things creditable of *Ireland* ſhall be a ſufficient reaſon for caution, in all that ſhall be laid before the Reader, in regard to GEMS: And previous to every thing upon this ſubject, the Inquirer declares honeſtly, that the ſpecimens which he ſhall hereafter mention, were not brought to the capital of this kingdom upon any opinion of their being valuable in any other reſpect, than that of flints and pebbles (*a*); except the Cryſtals, whoſe natural tranſparency,

(*a*) A late writer's remark upon thoſe who have hitherto treated this ſubject, ſhall be a reaſon for caution not to borrow any thing without an acknowledgment.

" The Lithologiſts are, indeed, of all Authors, the greateſt Plagiaries: Every one who " has read them, will find that reading one of them is much the ſame thing with reading " them all; and that, in a ſubject where perſonal diſcoveries went but a little way, they " have all adopted not only one another's ſentiments and opinions, but their words and " ſentences; Examples for which, even for whole pages together, are but too frequent " with many of them; and that without the leaſt hint at the name of the Author, or " that they were from any where elſe. Hill his General Natural Hiſtory, page 500.

What follows from the Scriptures and the Biſhop of *Ely*, is to ſhew, that Gems have been in high eſtimation, and that God himſelf highly regarded this part of his own workmanſhip, conſecrating them to religious purpoſes; and alſo, that it is extremely difficult to determine what Natural Appearances belong to the ancient names. Concerning the precious ſtones mentioned in the title page of this Lecture, *Fagius* writes,

" Eſt tanta etiam de nominibus iſtorum lapidum apud omnes interpretes cum noſtros " tum Hebræos diſcrepantia ut nemo fere quid certi ſtatuere poteſt." Crit. Sacri.

The Septuagint veroſin, according to the Alexandrian manuſcript, gives the Greek names of theſe ſtones, as follows, Σάρδιον καὶ τοπάζιον, καὶ σμάραγδος, ὁ στίχος ὁ εἷς. Καὶ ὁ στίχος ὁ δεύτερος, ἄνθραξ καὶ σάπφειρος καὶ ἴασπις. Καὶ ὁ στίχος ὁ τρίτος, λιγύριον καὶ ἀχάτης καὶ ἀμέθυστος. Καὶ ὁ στίχος ὁ τέταρτος, χρυσόλιθος καὶ βερύλλιον καὶ ὀνύχιον.

The

parency, figure and beauty inclined him to think favourably of them, that the improvement of Art would render them more estimable. Several

The Hebrew text with Montanus his translation is as follows,

Ordo primus	Odem	Rubinus	Ordo tertius	Leschem	Ligurius
	Pitdah	Smaragdus		Schebo	Achates
	Bareketh	Chrysolitus		Achlama	Amethystus
Ordo secundus	Nophech	Carbunculus	Ordo quartus	Tharschisch	Tharsis
	Saphir	Sappirus		Scholam	Onyx
	Iahalom	Adamas		Jaspeh	Jaspis

The first row shall be a Sardius, &c.] There is so little certainty what these stones were, that nothing can be affirmed about them; as appears by the vast variety of interpretations, that have been made of them, by writers both old and new: The first of them is called Odem in the Hebrew, which some take to be a Ruby, having no other reason for it, but because it signifies red. Others take it for an Adamant; which may seem to be derived from *Odem*, as a Jaspri is from *Jaspbe*. And there are several other conjectures, but none so probable as that of our Translators, who call it a Sardius, or Sardine stone, as they render it, (iv. Rev. 3.) which is of a red flaming colour, as Braunius hath demonstrated from several Authors (Lib. 11. de vest. sacr. Hebr. c 8. n. 8.). But as some describe it, with a cast of yellow in it like that of fresh oyl. And it is not improbable that this stone had the name of Sardius from the Hebrew word Sered, which signifies red, xliv Isa. 13. as Kimchi there interprets it. And thence the divine majesty is said to look like a Sardine stone (in the place above named) because he appeared in great anger. So an ancient writer, Διὰ τὸ φοβερὸν θεῦ, πυρροειδὲς γὰρ τὸ σάρδιον.

A Topaz.] The second stone in this row, is in Hebrew called Pitdah, which we truly translate a Topaz: which was a stone of a green colour, not a yellow, as we now commonly understand it. So Pliny and others, as the same Braunius shews, L. 11. c. 9. where he fancies that the word Topasion, by an easy change of letters, was made out of Pitdah: for the Syriack interpreter xxi Rev. 20. calls this stone Topadion; in which there are the same letters that are in Pitdah: but however this be, it appears from xxviii Job 19. that this is the right translation of the word; for there it is Pitdah Cush, the most excellent Topaz stones, being found in an island belonging to Arabia, called thence by the name of Topazion.

And a Carbuncle.] So we translate the third stone of the first row (which in Hebrew is called Bareketh) following perhaps Abarbinel. But the greatest part of interpreters take it for the Smaragdus: which good authors describe as the most radiant of all other stones; and therefore called perhaps Bareketh, from its extraordinary splendor. For Barak, every

ral of them being put into the hands of Lapidaries, Seal-cutters and Jewellers, particularly Meſſieurs Standiſh, Billing, and Nichols; and the Inquirer hearing

ry body knows, ſignifies to glitter, xxi Ezek. 10. The beſt authors ſay, the colour of it is a graſs green; wonderfully refreſhing (as Pliny deſcribes it) to the eyes when one looks upon it.

Ver. 18. And the ſecond row ſhall be an Emerald.] The Hebrew word Nophech, which we tranſlate Emerald, is by moſt interpreters taken to ſignify a Carbuncle, ſome of which ſtones are white; but the moſt excellent of all others are red, ſhining like fire, or a burning coal: whence the name of Carbuncle, from Carbo a hot coal, and to this the Hebrew word Nophech agrees; which Braunius ingeniouſly conjectures comes from Phuch, which ſignifies that red wherewith women painted their faces, 2 Kings ix. 30. and, in ſhort, he takes it for that ſtone which now we call a Ruby. And ſo Abarbinel tranſlates it, and Luther alſo; vid. L. 11. c. 11.

A Saphire.] This ſtone is mentioned before xxiv. 9. and it retains its name to this day, almoſt among all people. So that there is no queſtion, but only what kind of ſtone it was about which Authors differ. For ſome ſay it was a white ſtone (and there are ſome ſo pale that they incline rather to that than any other colour) but it is plain, that ſtone was called anciently a Saphire, which is now ſo called; being of the colour of the heavens or the veins, that is, a ſky colour. See xxiv. 10. v. Cantic. 14. iv. Lament. 7.

And a Diamond.] So we rightly tranſlate the Hebrew word Jahalom, which is thought to come from Halam, which ſignifies to break. Whence Halmuth is an Hammer or a Maul, v. Judges 26. For the Adamant or Diamond is the hardeſt of all ſtones; which breaks them all, but is broken by none, as Abarbinel ſpeaks. It was anciently accounted the moſt precious of all Gems, as Pliny acknowledges L. xxxvii. c. 4.

In the third row, a Ligure.] So we tranſlate the Hebrew word Leſchem, which being no where elſe found, the meaning of it is uncertain. But a great many, both of the ancient and modern, tranſlate it as we do: though what a Ligure is can not eaſily be reſolved. Some think Λιγύριον or Λιγκύριον, to be nothing but the beſt Amber. But that is no precious ſtone as all here mentioned are; and therefore (to mention no other conjectures) Braunius thinks we are to underſtand by this word, a kind of Jacinth; of which there being divers ſorts, he judges it likely to be that, which neareſt approaches to the colour of Amber, which hath made Authors take them for the ſame. The Ancients indeed commonly by a Jacinth underſtand a ſtone of a violet colour, but more pale and dilute than in the Amethyſt; and the ſtone now called an Amethyſt, was anciently called a Jacinth. Yet they mention Jacinths of divers other colours, and ſome ſhining like fire: vide L. 11. de veſt. ſacr. Hebr. c. 14. n. 11, 12.

An Agate.] So the Hebrew word *Schebo*, which is no where elſe mentioned in ſcripture, is tranſlated by the greateſt part of interpreters, who take this for that ſtone which the Greeks call Achates; which is ſo well known, that it needs no deſcription; being that beautiful ſtone which Nature has painted with great variety: from whence it hath got ſeveral names, as the ſame Braunius obſerves in the ſame book, cap. 15. n. 4. &c. And the very name of Achates ſeems to be derived from its various colours: And in Hebrew ſignifying that which is ſpotted, as Jacob's cattle were xxx. Gen. 35. Though now, becauſe they are common, they are of no great value: yet anciently it appears from Theophraſtus and Pliny, they were more precious.

hearing their unprejudiced judgment of them as Artiſts, and the judgments of Ladies and Gentlemen, for whoſe pleaſure ART exerts itſelf, and conſulting Authors who have wrote upon ſuch matters, may with ſome degree of confidence declare, that he has found upon the ſhores of Lough Neagh and in the neighbourhood of the Lake, not only Cryſtals and Agates, but Gems alſo deſerving the following denominations, Carnelians, Mocoas, and Pſeudo-Adamantes; and at ſome diſtance from the Lake, Topazes or Amethyſts. And in as much as his principal intention of ſearch was not for theſe, but for ſpecimens of another claſs, it may be preſumed, that would any perſon profeſſedly go in queſt of Gems on the ſhores of that Lake, ſuch quantities might be found, as would ſufficiently reward the ſearcher.

It is not long ſince there was any value put upon any ſtones of the production of Great Britain and Ireland, except thoſe of Briſtol and Kerry.

And an Amethyſt.] The Hebrew word Achlama is no more to be found in the ſcripture elſewhere, than the two former. But the beſt and moſt ancient Authors take it as we do, for that ſtone which other writers call an Amethyſt, which is of a bright violet colour, or like red wine, from whence it hath its name in the Greek. The nearer theſe ſtones came to purple, and the more they had of the flame of a Carbuncle, the more precious they were eſteemed, as the forenamed Braunius ſhews L. 11. c. 16. n. 56.

In the fourth row, a Beryl] The Hebrew word *Tharſchiſch* is very variouſly interpreted; but the LXX, Joſephus, and a great many others, take it for that which the Ancients call a Chryſolite; that is, a ſtone of a golden colour, which others call a Topaz. This Braunius endeavours to prove was the colour of Tharſchiſch out of x. Dan. 5, 6. v Cant. 14, &c. See c. 17. n. 12, 13, &c.

An Onyx.] The Hebrew word *Schoham* we meet withal in the beginning of the bible (ii Gen. 12.) and tranſlate it as we do here, an Onyx: But Joſephus, St. Hierom, and the Vulgar, tranſlate it Sardonyx; which was of a mix'd colour, of white and red; for the moſt precious Indian Sardonyx had a radix (as they call it) white, like the nail of one's finger; and the ſuperficies red like blood; and both of them tranſparent: from whence it had its name; the Sardius ſtone (as was ſaid before) being red, and the Onyx ſignifying the nail of one's finger. See the aforenamed Braunius, c. 18.

A Jaſper.] Though the Hebrew name, which is *Jaſpeh*, be retained among all people to this day, yet all interpreters have not tranſlated it as ours do, who, no doubt, are in the right. For why ſhould we not think Jaſpeh is certainly that ſtone which the Greeks and Latins call Jaſpri: As we doubt not the Saphire before mentioned (v. 18.) is the ſtone they call Saphirus. The beſt of theſe ſtones are of a green colour, like a Smaragdus; but ſometimes they have little ſpots or points in them, of various colours: which hath made ſome Authors call this ſtone Panthera. See Braunius, c. 19.

The Biſhop of Ely his Comment.

Kerry. The late Counteſs of Burlington was the firſt who made thoſe in high life inquire for Pebbles, owing to an accidental circumſtance: For her waiting-maid having an honourable amour with a jeweller, and receiving a viſit from him, amongſt other circumſtances of amuſement he ſhewed her ſome toys of his art, and happening to have amongſt them a Pebble, which he took up in his walk, ſhe was ſo pleaſed with its appearance, that ſhe requeſted it might be poliſhed for her; which being ſoon done, ſhe ſhewed it to her Lady, who was alſo pleaſed ſo well as to deſire that more might be collected for her. This was done, and a beautiful table made of them, placed in a kind of Moſaic work by her Ladyſhip's direction. This account is given upon the authority of a right reverend Prelate, who had not only a narrative of the matter from the Counteſs of Burlington; but a preſent alſo of an Engliſh Pebble ſet in the cover of a gold box. The ſame account alſo reſts upon the authority of a reverend Dean, who has the honour to be related to the family.

Of late years pebbles have been of ſome degree of eſtimation in this kingdom; and it is about twelve years ſince the INQUIRER, joining with ſome Gentlemen in an innocent frolic, to take a houſe on a bank over the ſea, near the harbour of Dublin, for an amuſement during a ſummer, uſed frequently to collect ſtones, and ſend them to Lapidaries to be poliſhed. Each Gentleman of the party ſeemed to contend with the reſt, for preference in good fortune to find, and judgment to diſtinguiſh, what would look moſt beautiful when improved by mechanic arts: The ſucceſs of the moſt fortunate was not at that time of great eſtimation. But the beauty of that ſituation having of later years invited ſo many to build country houſes for retirement, that the ſea ſhore for two miles is become almoſt a town, and it is a very general employment to pick up the Pebbles which are moſt inviting to the ſight. Mrs. Heany in particular, a very agreeable wife of a very worthy Clergyman, whoſe reſidence is there, it being her huſband's pariſh, can ſhew ſeveral ſtones collected there of excellent beauty, but one eſpecially, which is a Carnelian, in which ſhe had an emblematical figure of Liberty cut, and it is ſet in gold. About the ſame time alſo a part of the ſea ſhore, not fifteen miles ſouth from thence, became very famous for beautiful Pebbles. The MURRAGH of Wicklow is now ſo well known in this reſpect, that it is

almoſt needleſs to deſcribe it; yet to foreigners, into whoſe hands this account of Gems may poſſibly fall, it may not be diſagreeable to have a few lines beſtowed upon it.

From the town of Wicklow, northward towards Dublin, there is an uninterrupted flat country for ſix miles along the ſea ſhore, and extending into the main land to different diſtances; without partitions of fences, till of late years the occupiers regarding husbandry, which requires incloſures, have by building, planting, and fencing, taken in all the flat area, except about the breadth of an hundred yards, which for the length of ſix miles remains a ſmooth ſurface of beautiful verdure for walking or riding. From the ſod, which is a coat of graſs upon a maſs of mixt matter, conſiſting more of Pebbles than earth, there is a ſlope to the loweſt water-mark, which is ſometimes merely fine ſand, ſometimes a heap of Pebbles to the height of three or four feet and of conſiderable breadth. For it ſeems that one tide ſhall throw up ſuch a heap, and another tide ſhall waſh them all away: ſo that particular tides, aided by particular winds, make particular kinds of ſhores. And as there are a great variety of the former, ſo are there alſo of the latter. Hence it is that many perſons find their account in ſearching this ſhore for ſuch ſtones as may admit a beautiful poliſh. For the ſea is always furniſhing the ſearchers with new heaps, or the ſame one often turned. So many ſtones of real beauty have been found here of late, that this place has acquired a great fame in this reſpect; but our Deſign almoſt confining us to Lough Neagh, we muſt return to that.

Having below given ſuch an account of Gems as is ſufficient to raiſe not merely eſteem for them, but an affection of a higher Nature, and that upon the authority of a divine law, here ſhall be given a proof of another kind, and the high regard paid to Gems ſhall be proved from a falſehood and a mere Impoſition. For as Hypocriſy in morals proves the value of true virtue, ſo do lies and impoſitions of all kinds prove the value of the real things, they are deſigned to paſs for.

Mr. Carte in the preface to his edition of Thuanus tells us, that of two former editions of that Author's works publiſhed with his own allowance, one of them contained the following ſtory, the other not.

" Whilſt

" Whilſt the King was at Bologna, a ſtranger, who ſeemed to be " rough in manners brought a wonderful ſtone to him from the Eaſt " Indies. It was aſtoniſhingly luſtrous, and appeared as if it was al- " together fire, and emitting a conſiderable quantity of rays on all ſides, " was hardly to be born by human ſight. Another wonderful circum- " ſtance of it was, that if it was buried in the earth, it would by its " own virtue break forth from its confinement with violence: It could " not be contained or included in any narrow ſpace; but ſeemed to " delight in open and free ſpace only. It had the moſt perfect purity and " ſplendor, without any, even the leaſt ſtain of foulneſs. It had no cer- " tain figure but was variable, and that inſtantaneouſly: and in as much " as it was extremely beautiful to behold, it raiſed a deſire in ſpecta- " tors to handle it, which yet it would not ſuffer with impunity; and " if ſome more reſolute than others attempted to handle it, they ſuf- " fered pain by it; this many perſons tried in the preſence of many. If " any part, by the more obſtinate attempt of perſons to handle it, was " taken off (for it was not very hard) it did not thereby become leſs. " The ſtranger ſaid, the virtue of this Gem was uſeful in many re- " ſpects, but peculiarly neceſſary for Kings; but this he would not re- " veal without a conſiderable reward.*"

This

* In fine prioris tomi Drouartiani mira de lapide Indico legitur narratio, quæ in Pateſſoniano volumine non comparet. Verba ita ſe habent.

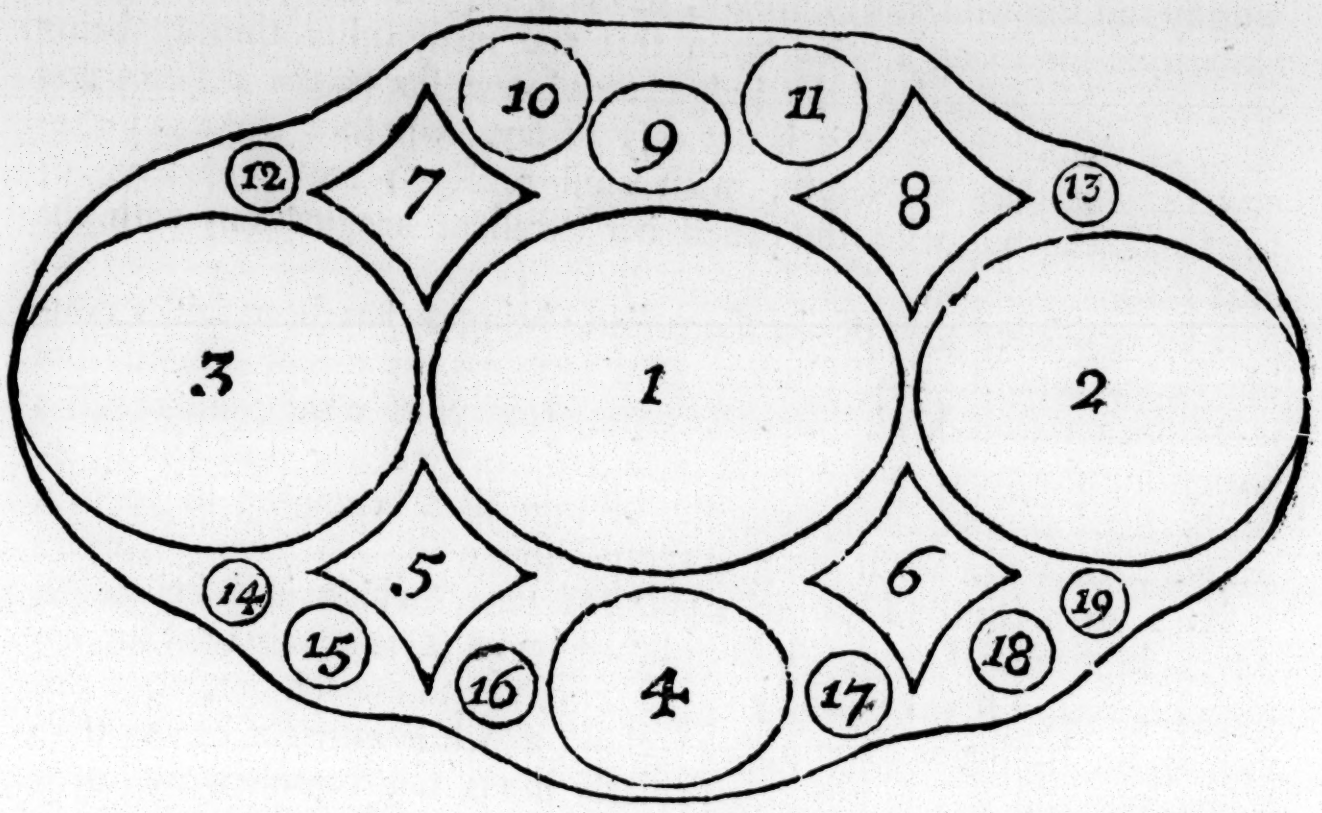
P. 453, l. 3. Poſt *exolvit* adde. Dum Rex Bononiæ eſſet, allatus eſt ad eum ex India orientali, ab homine incognito, ſed, ut apparebat, moribus barbaro, lapis ſtupenda ſpecie et naturâ, videlicet lumine et fulgore, mirabiliter coruſcantibus, quique totus velut ardens incredibili ſplendore micabat, et jactis quoquo verſus radiis, ambientem aerem luce nullis fere oculis tolerabili latiſſime complebat. Erat et in eo mirabile quod terræ impatientiſſimus, ſi cooperiretur, ſua ſponte et vi, facto impetu, confeſtim evolabat in ſublime; contineri vero includive ullo loco anguſto nulla hominum arte poterat, ſed ampla liberaque loca duntaxat amare videbatur. Summa in eo puritas, eximius nitor, nulla ſorde aut labe conquinatus. Figuræ ſpecies nulla ei certa ſed inconſtans at momento commutabilis, cumque eſſet aſpectu longe pulcherrimus, contrectari tamen ſeſe impune non patiebatur, et diutius contra adnitentibus, aut obſtinatius cum eo agentibus incommodum afferebat; quod multi, multis ſpectantibus ſunt experti. Si quid fortaſſis eo enixius conando detrahebatur, nam durus admodum non erat, nihilo minor fiebat. Hujus virtutem ac vim eſſe ad quam plurima cum utilem, tum præcipue regibus neceſſariam, aiebat hoſpes, qui miraculum oſtentabat, ſed quam revelaturus non eſſet, niſi ingenti pretio prius accepto. Hæc ut in literis Jo. Pipin occulati rei teſtis, qui in familia A. Momorantii M. E. medicinam faciebat, ad Ant. Mizaldum, et ipſum inſignem medicum pridie aſcenſionis.

This account has more the appearance of a riddle than a true hiſtory, and if an artful man could convey ſome of the Linſter coal of this Kingdom which does not ſmoak, to a perſon in a country where pit-coal is unknown, as it is ſaid, Engliſh coal is ſhewn in the collection of the Duke of Tuſcany as a Rarity, the riddle may be explained by burning it. But the only uſe that ſhall be made of this ſtory is, that whereas the ingenious relator has left it ~~out~~ of one of the editions publiſhed by him, it is likely, he found he was groſsly impoſed upon: and therefore all perſons of Natural Inquiry ſhould be very cautious in believing reports, and ſhould relate few things of which they have not ſenſible evidence. The preſent Inquirer means to obſerve this caution in what he is about to relate concerning the Gems of Lough Neagh.

The natural appearance of all the Gems found at Lough Neagh are already deſcribed Lect. 3. from N. cclxvii. to N. cclxxi. There was one found about fifteen miles from the Lake, which deſerves a deſcription alſo. It was a tranſparent coloured ſtone, with an hexangular column and pyramid, of no great beauty in its natural ſtate, but extremely beautiful when poliſhed. It was large enough to have made a triangular ſeal of a common ſize, but the Artiſt breaking it, in order to ſee whether it was worth labour, found it of a pure texture, hardneſs, and homogene appearance, and poliſhed each fragment into one form of different ſizes, for ſtones for rings. It is the colour of Burgundy in many views, and yet in particular lights it has more or leſs of that and ſome other colours; ſo that different ſpectators give it different names: ſome claſſing it with the Amethyſt, ſome with the Topaz, all allowing it to be beautiful. The Amethyſt ſignifying a Grape of the colour of red wine as well as a Gem, ſeems to have the beſt title to give a Name to this Gem. The Inquirer has of this kind one that weighs above three ounces, but being foul does not merit a deſcription. And whereas the pure Amethyſt was poliſhed into the form of Diamond-cut ſtones, one of theſe is ſet in gold along with ſome ſparks of the Pſeudo-Adamas in trefoil, and is a beautiful ring in the cuſtody of Mrs. Elinor Barton, the Inquirer's ſiſter-in-law, who rates it at an high degree, perhaps

ſionis Bononiæ datis, perſcripta ſunt, ita trado, et amplius diſcutienda phyſiologis relinquo: Nam veteribus, qui de rebus hujuſmodi ſcripſerunt, ſimilis lapis necne cognitus fuerit, nec Pipinus iis literis, ſe ſcire dicit, nec ipſe affirmaverim.

perhaps above the value, upon account of perſonal regard to the Donor.



The figure prefixt to this part of the Lecture repreſents a deſign which the Inquirer is about executing, that is, to have ſpecimens of the ſeveral kinds of Gems and Agates of his finding, ſet in the form repreſented there, being the lid of a large box, of ſufficient depth to contain many others of the ſame kind within. Having as yet gone little further in poliſhing than thoſe deſigned for the lid, few elſe ſhall be deſcribed here.

N. 1. is part of a Carnelian deſcribed N. cclxx. Lect. 3. It is evidently two ſtones naturally adhering ſo as to anſwer the purpoſes of firm continuity, there having been a third of the ſame denomination adhering to the flat ſurface of one of theſe, which, when the Artiſt was deſired to break it tranſverſely towards one End, in order to diſcover how far a viſible line which appeared like a flaw penetrated, ſeparated from the reſt of the maſs, with a moſt equal ſmooth flat ſurface. This piece being of a larger diameter than the reſt, and of an oval form, was immediately poliſhed for a top to a ſnuff-box. The poliſh of it is exceeding fine, and

and it partakes of the nature of a red Carnelian in one part, and of a yellow in another. It is in the cuſtody of Mrs. Delany, Lady to the worthy and learned Dean of Down, whoſe approbation might be ſufficient foundation for fixing a value upon this and many other things, being one, who has joined all the judgment of one ſex to the delicacy and fancy of the other, that it is not eaſy to ſay, whether her mind conceives the beauties of Nature, with moſt readineſs and propriety, or her hands execute with the pencil her excellent imaginations with the moſt ſkill.

The remaining part of the Carnelian, being as has been ſaid a double ſtone, is poliſhed alſo into an oval form for the top of a box, but is left thicker than uſual. It has a repreſentation of what painters call a Glory in one part, when held between the ſpectator and the light. N. B. Moſt part of the appearance of raw fleſh belonging to it in a natural ſtate, was ground away in the poliſhing.

N. 2. is a Mocoa ſtone in a poliſhed ſtate, which is deſcribed N. cclxix. in a natural ſtate. It is poliſhed into a form nearly oval for the top of a box. It is extremely hard, ſmooth and tranſparent, but not equally ſo, having in ſome places a cloud which is rather a beauty than deformity, and in one place particularly has a fair repreſentation of a wind-mill in it (*b*). Some parts of the large maſs had Dendrites in them: Therefore this ſtone ſhould be called a Mocoa.

N. 3. is a moſt beautiful Agate, poliſhed into the ſame form for the ſame uſe, tranſparent in the thin part only. It is a congeries of ſeveral fragments of Agate cemented by a hard matter, but not ſo hard as the Agate itſelf, which being in a ſmall quantity in proportion to the matter cemented, does not hinder the whole maſs to take a charming poliſh.——The colour of the fragments of Agate is cheſnut, the colour of the cement inclines to white: Of this and the Mocoa mentioned Mr. Benjamin Barton has ſets of ſleeve buttons, which he eſteems highly, perhaps with a good degree of brotherly affection above the mere value of the ſtones.

N. 4.

(*b*) Another part of this maſs has a beautiful repreſentation of a ſheet of water; a third has that of an honey comb; a fourth has that of a creſcent, or half moon: The colour of the ſtone is in ſome places that of Champagne, in others it is ſomewhat milky.

N. 4. is a black Agate, with ſome white, which affords a whimſical figure, that of a Capuchin, with hood, cap, eyes, noſe, mouth, chin, and hands lifted up, fairly repreſented: This therefore we will call the Capuchin Agate.

N. 5, 6, 7, 8, are different kinds of Agates all beautiful, yet not eaſily admitting particular deſcriptions.

N. 9. is a piece of the Topaz or rather Amethyſt already deſcribed in this Lecture.

N. 10, 11, 16, 17, are pieces of the maſs of Pſeudo-Adamas deſcribed N. cclxvii. and mentioned in other places of theſe Lectures. This extraordinary maſs, in being rolled aſhore by the agitation of the water in ſome ſtorm, which tore it from its place of growth, received ſome cracks, which gave occaſion to break it into different blocks, out of which are made ſeveral ornamental things, particularly ſleeve buttons, ſeals of different forms, triangular, pyramidal, &c. and one diamond-cut maſs weighing one quarter of an ounce, of an exceeding fine water. Another of the ſame form but much larger, weighing one ounce and fifteen grains brilliant-cut, in order to be a model of the famous Diamond which goes under the denomination of *Pits*. It is not eaſy to deſcribe the beauty of this ſtone, and therefore we ſhall leave it to others who have ſeen it, and admired it, to ſpeak of it as they think proper.

The Pſeudo Adamas deſcribed N. cclxviii. is poliſhed into a form for a ſeal of a large ſize, and is a fine Gem, in the cuſtody of Mrs. L. Buſh; a Lady of whoſe ſkill in drawing there is a proof exhibited in the frontiſpiece of this Book; but if her volume of Perſpective Views were laid before the Curious, our country would reap ſo much credit by it, that its not being done is matter of concern to all who know the value of them. If an Inquirer into Nature could repreſent the occult phænomena, as truly, as this Lady can the beauties of the viſible world, his performance muſt pleaſe the judgment as much, as hers do both judgment and fancy.

The reſt of the ſtones numbered in the lid of the box mentioned, are different kinds of Pebbles, which tho' extremely beautiful can not eaſily be expreſſed to purpoſe in words, ſo as to give that information to the imagination, which ſhould make it worth while to attempt it. But as a recommendation of the value of ſome of them, John Stear, Eſq; of

the county of Meath, a Gentleman of real worth and diſcernment in many things of value, has a ſet of ſleeve buttons of one kind of them; and other Gentlemen have of other kinds: All which are eſteemed. Beſides theſe, there are many ſtones not yet poliſhed in the collection, and which therefore can not be deſcribed here. The Printer and Bookſeller hereof have ſpecimens of ſome of theſe Gems ſet in gold, which are worth notice; but the maſſes from which they were cut being deſcribed need not be mentioned again. Our Hiſtory of Iriſh Gems might perhaps be inlarged, if the Reverend John Payne, a very worthy Clergyman, was near at hand, to give information to his acquaintance in what he has diſcovered in this reſpect: This Gentleman deſerves to be known in more kingdoms than one, by thoſe to whom ingenuity is a recommendation. It is as poſſible for men of worth to lie hid in the world, as for Gems to lie concealed on the ſhores of a Lake.

This account, although of few ſpecimens, being the firſt attempt of the kind to raiſe an expectation to find GEMS of eſtimation in Ireland, it is hoped that others will be encouraged to ſearch for more, and that all perſons will eſteem their ſearches. For the excellent Hiſtorian of the Royal Society obſerves: THERE IS A REVERENCE DUE TO THE FIRST TRIALS AND INTENTIONS, AS WELL AS TO THE LAST ACCOMPLISHMENTS OF GENEROUS ATTEMPTS.

Having thus deſcribed the mechanic forms and uſes of our Gems, ſome reaſoning muſt be beſtowed upon the natural production of them, eſpecially ſince a long prevailing opinion concerning them has been found weak. Cryſtal being the baſis of almoſt all the admired Gems, its generation ſhould in the firſt place be accounted for. You are here requeſted to bear in mind, what has been already laid before you, concerning the Petrifications of Lough Neagh, to wit, that ſo many of the ſpecimens have ſuch plentiful indications of cryſtalline matter in them, that it is a fair preſumption; that they all are principally wood metamorphoſed by that ſort of matter, and that cryſtalline effluvias abound in moſt parts of this Lake, and alſo in its neighbourhood. But not to come too quick upon a Solution of a phænomenon well worth attention and a methodical proceſs, hear firſt the introduction of Schuitzer, when he is about to ſpeak of this matter, in the account of his journey (c) through

(c) Lugd. Bat. p. 233.

through the Alps, which have had hitherto the greateſt fame for theſe productions, but it is hoped ſome other places are likely to be found as well deſerving a reputation in this reſpect.

Nunc ordo rerum in hoc Sancti Gotthardi cacumine peragendarum me ducit ad χρυσαλλο-γραφίαν, rem ut curioſiſſimam, ita difficillimam, quæ ingenia ſubtiliſſimorum etiam philoſophorum ita torſit, ut ad hanc uſque diem ſeſe ex variarum rerum circa hanc materiam occurrentium labyrinthis extricare non potuerint — Trahit patria lapidibus his vel gemmis nativa — hoc certum eſt quo altiore loco eruantur cryſtalli, eo quoque majores illas eſſe puriores et pretioſiores. Schuitzer has not given the weight or ſize of any Cryſtal in his catalogue of curious Cryſtals. Doctor Woodward mentions one under the character of very large, Cat. Eng. foſſ. 2 part p. 158. in theſe words: "A ſingle column or ſhoot of Cryſtal very large, being 3 inches in length, and $1\frac{1}{2}$ in diameter near the baſe. Yet this Cryſtal was not above one fourth part of the maſs that was found on the ſhore of Lough Neagh, weighing two pounds two ounces. The ſhapes of the ſurfaces are given in Plate 6. fronting Lect. V. Fig. 5. in a ſmall ſcale: And whereas there are thirteen ſurfaces delineated, it ſhould be conſidered as a Cryſtal of ſix ſurfaces in the column and ſix in the pyramidal part. For the baſe where it adhered to the rock is delineated as one of the ſurfaces. This Cryſtal having a crack almoſt half through the body of it, it was neceſſary to break it; and in order to do this, the Artiſt taking it in one hand, and ſtriking it with a wooden mallet in the other; he was obliged to give above a ſcore ſtrokes, before he broke it: Out of one of the fragments, which was cut by means of emery and a plate of metal turned by a wheel, there was an intention to have had the exact model of the Diamond called by the name of Pits, which, they ſay, was ſold to the King of France for 120000 *l.* but it exceeded that in ſize and is a charming ſtone, weighing an ounce and fifteen grains. Its luſtre is very conſiderable, and the hardneſs (which is always proportional to it in pure ſtones) exceeding any that have been poliſhed in this kingdom. The reſt of the fragments were intended for ſpectacles, and plates, to cover enamelled pictures. A much larger Cryſtal than this was found ſome years paſt in the county of Antrim, in the hill called Knockclaid near Ballycaſtle. A Peaſant ſpying it, where a torrent had waſhed away the earth, that incom-

paſſed it in its native bed, took it home, and his pleaſure of view ſoon palling, he careleſsly made uſe of it in building a ſort of a wall, to keep cattle from his garden: A Gentleman who was hunting, having occaſion to have part of that wall thrown down, was ſtruck with the gliſtening appearance of this ſtone, and purchaſing it for a very ſmall price, he took it to London and ſold it at a greater. The weight of the Cryſtal was thirty pounds (*d*). He reſerved ſome chips, which he had poliſhed into forms for his own uſe; but what eſtimation they have with him and others, the Inquirer will not take upon him to ſay, not having an opportunity of ſpeaking to the Gentleman himſelf concerning it; yet as much as is related he can vouch upon the authority of a very worthy Clergyman (*e*). The deſign of mentioning this is principally upon account of the weight: Could the hardneſs, luſtre and value of it be alſo accurately told, it would anſwer another purpoſe, in regard to the remark made by Schuitzer: Hoc certum eſt quo altiore loco eruantur cryſtalli, eo quoque majores illas eſſe puriores et pretioſiores. Some cryſtals found on the ſhores of Lough Neagh mentioned above, are better than the Cryſtals, which are poliſhed and ſold here under the title of the Cryſtals of Geneva: Yet the native bed of the large Cryſtal was in all probability under the water of the Lake, and being torn from the rock to which it adhered, was rolled aſhore in ſome ſtorm, and therefore though a very pure Cryſtal, it ſuffered damage in its journey, which made it neceſſary to break it, before it could be determined, which was the moſt prudent manner to cut it, to make it anſwer the beſt uſes. The finding of this ſpecimen, and trying it by the rules of Mechanic Arts prove two things, firſt, the weakneſs of Pliny's opinion (Glaciemque eſſe certum eſt (*f*)).

For

(*d*) Magnitudo ampliſſima adhuc viſa (Cryſtalli) nobis erat quem in capitolio Livia Auguſta dicaverat librarum circiter quinquaginta. Plin. N. H.

(*e*) The reverend archdeacon Boyd, brother to a Gentleman to whom the public owes a great deal, for his excellent works at Ballycaſtle: Poſterity will acknowledge it if the preſent age does not.

(*f*) Non alibi certe reperitur, quam ubi maximæ Hibernæ nives rigent, glaciemque eſſe certum eſt——non reperitur in aquoſis quanquam in regione prægelida, vel ſi ad vada uſque glacientur; cœleſti humore parvâque nive id fieri neceſſe eſt ideo caloris impatiens. Nat. hiſt. l. 37. c. 2. Every remark here is ſhewn to be weak by the production of

Cryſtals

For the production of Cryſtals in a country, where froſt has very little influence, and in the bottom perhaps of a Lake, where the keeneſt cold, was the climate ſubject to it, would ſcarce reach, is ſufficient to ſhew the weakneſs of his opinion, that Cryſtals are ice hardened; if

Cryſtals in Lough Neagh, and experiments upon Cryſtals mentioned elſewhere in theſe Lectures *.

* One circumſtance eſpecially, that of intenſe cold being thought neceſſary to the production of Cryſtals, has been an error of old date. There is no country ſo free from intenſe cold as Ireland. Even in England which is colder than Ireland, moſt of the froſts that occurred in almanacs, and hiſtories, are as follow. 1076 A froſt from the beginning of November to the middle of April. Rapin's hiſt. fol. Vol. I. p. 181. Note 17.——1517 A great froſt; carts paſſed over the Thames from Weſtminſter to Lambeth, page 737. N. 2.——1607 A great froſt. Dove's almanack.——1642 A great froſt.——In an old almanack of Pelletrin for 1642, we read in the table of memorable things, Since the blazing ſtar and froſty winter 70 years, that is, in 1572 there was ſo remarkable a froſt as to make it worth notice 70 years after.——1683 The winter this year was very remarkable for a violent froſt which began about the beginning of December, and laſted till the 5th of February. The Thames was ſo frozen, that there was another city as it were on the ice, by the great number of booths erected between the Temple and Southwark, in which place was held an abſolute Fair, for above a fortnight, of all ſorts of trades. An ox was likewiſe roaſted whole, bulls baited, and ſuch like.——There was a great froſt before this in 1607, and another ſince, in 1739-40. This laſt being in our memory and obſervation, ſeems to have exceeded all thoſe mentioned in hiſtory. The Thames was at that time a moſt horrid ſpectacle. For the froſt coming on with a moſt violent and keen wind, in ſo much that ſeveral travellers were frozen to death the night in which it began: The quantity of ice made in the Thames being broken by the tide, into large and irregular fragments, floated backwards and forwards with a motion that excited horror, and being interrupted by the bridge at London, was raiſed on one ſide into a pile that equalled the higheſt battlement; and the whole ſurface being fixed in a frozen ſtate the night following, continued ſo, near three months: To look upon the Thames metamorphoſed into frozen Alps was terrible and ſhocking, and more ſo, to ſee forty thouſand watermen turned out of their element and begging with mourning boats, which they carried through the ſtreets. By this froſt Lough Neagh alſo was frozen over, which being mentioned in other parts of theſe Lectures, there is no occaſion for repetitions. Let it ſuffice to obſerve, that the ſurface of the Lake was ſmooth, and afforded excellent travelling to horſe and foot, from one county to another, without any account of unfrozen parts which might be attributed to ſprings, upon any authority that can be depended upon †. The Inquirer being then in London, could not make obſervations

† It is probable if there were many ſuch, ſome misfortune would have happened to travellers, who by falling into them might give occaſion to their being ſpoken of and remembered.

if it was not already done by what is ſaid in the demonſtration of propoſition 10. Lect. 2. For ſince one certain degree of heat diſſolves all kinds of ice, Cryſtals would be capable of that diſſolution, were they nothing but hardened water: whereas by experiments Lect. 3. the greateſt heat of an air furnace is not capable of making any other alteration than that of colour and brittleneſs, in a ſmall degree (*g*).

But to come directly to the main point, and to aſſign the phyſical cauſe of the cryſtalline bodies found in and about Lough Neagh; let the account of the extraordinary ſpecimen N. cclxi. of Lecture III. be referred to in particular as well as moſt of the ſpecimens deſcribed, and alſo what is ſaid in the hiſtorical Lecture. It appears from all theſe laid together that a cryſtalline effluvia aſcending in different parts of the mix'd area of waterand land, which is the extent of the inquiry intended to be laid before you, being about thirty miles diameter, near half of which at leaſt may be ſuppoſed to be water, that a cryſtalline

ſervations upon the Lake in this reſpect. If every froſt mentioned above had the ſame effect in Ireland (whoſe records ſay nothing of them) yet it is not likely they ſhould produce Cryſtals according to Pliny's hypotheſis: For if the almoſt perpetual freezing in the Alps be the cauſe of Cryſtals there; the few froſts mentioned in the courſe of 700 years can not well be ſuppoſed to produce them here. Beſides, if freezing be the cauſe, it ſhould ſeem the keeneſt would make the hardeſt and beſt; but the Cryſtal found in Lough Neagh weighing two pound two ounces is much harder than thoſe brought from Geneva; and the luſtre is alſo ſuperior: For this reaſon it is not improper to call it a Pſeudo-Adamas.

(*g*) Before the phyſical cauſe of the production of Cryſtals be aſſigned, which immediately follows in the text, it may not be improper to lay before you Doctor Woodward's account of Cryſtals, as quoted by Schuitzer, together with ſome obſervations made in Kerry by the Inquirer.

Dignoſcantur facile cryſtalli forma corpora in fiſſuris perpendicularibus reperta, ab illis, quæ in ipſis ſtratis ſunt locata. Prioris generis cryſtalli non carent ſua radice (ita vocant rei gemmariæ periti abruptæ cryſtalli veſtigium, quo mediante lapidibus vel fiſſuræ parietibus adhæſit) quæ inveniuntur in terreis, arenoſis, aliiſque id genus ſtratis, undique ſunt ſolutæ, et pro in integræ, nullo apparente cohæſionis indicio *. Quæ vero immerguntur ipſis lapidum marmorum vel alius ſolidioris materiæ ſtratis, difficulter admodum ſeparantur ab his, quoniam undique circumdantur, vel ſi ſolvantur, abruptionis veſtigia ex omni parte oſtendunt: differunt adeo ab illis, quæ in perpendicularibus intervallis occurrunt, quod hæ, uti jam annotavimus, ex una duntaxat parte adhæſionis indicia exhibent.

In Kerry, Cryſtals are found in another manner than any mentioned by Schuitzer as quoting Doctor Woodward. For the Inquirer has had them dug in the mountains, and found ſome of them in the firſt earth turned up by the ſpade; in this earth were very few ſtones of any kind, and none to which the Cryſtals adhered; they might be pick'd out of the earth with ſeemingly torn roots *, yet not adhering to any hard matter.

cryſtalline effluvia is producing phænomena of very different viſible appearances (*b*). For in the ſame maſs, particularly N. cclxi. there is foul cryſtal, coarſe ſtone, and mere wood all continuous: the original body was wood alone, which falling into this bed of metamorphoſis, received the effluvia differently according to the difference of its pores, and retained them according to different degrees of attraction; ſo as to form a ſpecimen of various matter. Where the effluvia meets with no foul matter in its journey upwards, it may perhaps form a pure Cryſtal, or Pſeudo-Adamas adhering to ſome rock, ſuch as is deſcribed N. cclxvii. where it meets with metalline matter, from which it receives a tincture it may form coloured Gems, ſuch as Topazes and Amethyſts, as mentioned in the beginning of this Lecture. Or if it meets with ſulphur it may receive a tincture more eaſily, than in the denſe form of hardened Cryſtal, as in the experiment mentioned page 107. where the Cryſtals of the north and ſouth of this kingdom being put under the torture of intenſe heat ſuffered a little alteration in colour, reaſonably attributed to ſulphur which had been undeſignedly left in the crucible; whether a leſs degree of heat would not have cauſed this, the artiſts can tell, who know how to change the colours of many natural ſtones; perhaps a much leſs heat would do, becauſe it would not anſwer their purpoſe to make them brittle, as it ſeems an intenſe heat does.

ter. Moſt of theſe Cryſtals were pure and tranſparent throughout: whereas thoſe which adhere to rocks are for the moſt part muddy and opaque towards the root. Deeper than twice the depth of a ſpade, beds of Cryſtals were ſometimes found, where they adhered in great abundance to ſtones of various ſizes from five to fifty pound weight; which ſtones ſeemed to be a foul mixture of opaque matter along with cryſtalline matter. There were Cryſtals with two pyramids to one column, being formed without any ſeeming adheſion to any thing, ſome double columns with pyramids to each, and both columns ragged at the other end, and ſome double pyramids placed baſe to baſe without any column.

(*b*) If any one ſtill conceits that Cryſtals are water hardened, it will puzzle him prodigiuſly to account for the figures of them, and the poſition. For they ſhoot into one another, ſo as to penetrate half a pyramid, or paſſing through, to be incompaſſed by other Cryſtals; they ſhoot perpendicularly upright, contrary to the nature of water, which is to form ſtalactites in a pendant poſture: Recollecting what has been ſaid, and viewing only one maſs of Cryſtals formed in this intangled manner, may ſuffice to convince any one of the weakneſs of ſuch an opinion: But the effluvia mentioned above can not be liable to theſe objections, ſince human art acting along with nature in chymical proceſſes, is capable of producing ſo many phænomena with ſalts not totally diſſimilar from the formation of Cryſtals.

does. A Gentleman of ingenuity acquainted the Inquirer of a change of the colour in the ſtones of a buckle, with ſome ſurprize, in the following language, " I certify that ſince the year 1745 having worn " a buckle in my neck, ſet with forty colourleſs tranſparent Cryſtals, " I found in a ſhort time they acquired colours, firſt a yellowiſh " Topaz, then fine Emerald green colour. Eight are in the latter " ſtate, two in the former, and ſix in an intermediate ſtate of colour- " ing, the reſt though at preſent colourleſs, I expect, will change."

This Gentleman's opinion was, that the ſtones really acquired colours; but the Inquirer having them examined by an artiſt, it appeared, that the ſtones were as colourleſs as ever, but a green foil had grown under them which gave a beautiful colour to ſome of them. The cauſe of this perhaps may be the oil which is uſed in wigs, inſinuating into the cavities of the ſockets, in which the ſtones lay, the ſetting not being perhaps quite as accurate as it ought to be, and the buckle being worn on the neck. For it ſeems theſe ſettings are commonly in metal below ſterling, which has a mixture of copper or braſs, which is capable of a green ærugo. In ſix years time therefore thoſe phænomena might be produced. Artiſts however have a method of changing the colours of many precious ſtones, as well as imitating their ſubſtance by paſtes. Theſe myſteries being only known to themſelves are not to be explained here. It is ſufficient at preſent to aſſign a general cauſe, to wit, a cryſtalline effluvia; and when future ſearches give a larger ſcope of obſervation, particular productions may be explained by particular kinds of matter, in different apartments of the earth mixing with this common vehicle. Where the cryſtalline effluvia aſcends freely and purely it forms pure Cryſtal, and in particular caſes coaleſcing into exceeding hard maſſes may deſerve a name of a particular kind of Gem, tho' leſs excellent than a Diamond, yet more ſo, than thoſe, which here paſs under the names of Briſtol, Geneva, and Kerry ſtones; when the effluvia meets with ſtrata of matter from whence it acquires a brown tincture, it forms the brown and brittle Cryſtals of Cranfield, deſcribed in Lecture V: when it meets with coarſer matter, it forms coarſer maſſes ſcarce diſtinguiſhable from common ſtone; of which there are many ſpecimens at the place juſt mentioned; the tranſparent Cryſtals growing between rocks,

rocks, which ſeem to be maſſes of the ſame matter rendered coarſer by an intermixture of coarſer matter.

As to the quick generation of Cryſtal; the opinion generally prevalent in the neighbourhood of Cranfield ſpring is, that it grows in a night's time, particularly the firſt of May. For the people alledge that if the well be emptied on May eve and the Cryſtals be all ſwept away, there will be found next morning a conſiderable quantity of them, which grew in that time. The INQUIRER is very well inclined to think that their growth is quick in that place, becauſe within about two miles of the well, where they are found in great plenty cloſe upon the Lake, ſo as to be covered by the water of it in winter time, and lie in the crevices of a kind of rock, capable of being broken with a common ſpade; he obſerved them alſo growing in the thin ſod which lay above the rock towards the ſkirt of the land, and which ſod had all the appearance imaginable of a very late generation: But having never had time freely at command, he could not allow himſelf to ſtay, to make obſervations ſufficient to this purpoſe. But the Gentlemen in the neighbourhood may perhaps from theſe hints be induced to make obſervations which may perhaps aſcertain the matter.

CONCLUSION.

Longæ chartæque viæque finis.

HAVING thus finiſhed our book and journey, for ſo it may be called, ſeeing that a man may travel as much ſpace by moving in a circle round a Lake, as in a direct line to Grand Cairo, there is ſome joy ariſes, which itſelf alone may be called a ſort of reward. The traveller wiſhes to tell his ſtory, and when he has told it, to be credited. The Inquirer has told his ſtory, but what credit it may have with the reader, he waits to know. If any reaſonable objections occur, which ſhall be offered with good manners, a reply ſhall be made with the ſame courteſy, or not at all. If any perſons through petulance object without reaſon, the Inquirer is prepared—not to anſwer, but to—bear. He meaned well in his ſearches, and alſo in the publi-

cation. If the account be not executed as fully and correctly as the ſubject requires, let ſome other perſon profecute it to better effect: For it is not offered as a compleat hiſtory of that Lake, which has more materials for a natural hiſtory than any area either of land or water of the ſame dimenſions, which the Inquirer has ever been acquainted with. It is larger than the iſle of Barbados, which lately afforded a natural hiſtory in folio, at one guinea, and one and an half ſubſcription, with near one thouſand ſubſcribers, and was written by a Clergyman. Natural philoſophy therefore is a part of knowledge highly rated, as it ought to be, and not unbecoming one whoſe principal occupation ſhould be the ſtudy of the divine law. For is not this divine law written in the book of nature as well as revelation? Is one intelligible without the other? Do not the moſt eminent artiſts in painting, ſome where mark a ſignature, whereby they mean to be known; yet to find which coſts the ſpectator ſometimes much pains? Is not the divine ſignature in this manner painted in every phænomenon, but obſerved only by the ſtudious? The great Newton concludes his book of nature, with the attributes of the Deity drawn from nature: The Inquirer would do the ſame, was he equally acquainted with the volume of the natural world. But one glorious circumſtance of religion is, that it conſiſts more of the honeſty of the heart, than the ſagacity of the mind; what is not in every man's capacity to comprehend, may yet be a proper ſubject of faith to an honeſt judgment; and a good man may ſubſcribe to a creed, which he could not indite. The beſt writers in defence of religion have been thoſe, who were beſt acquainted with the power of God in the natural world. The firſt lectures publiſhed in conſequence of the religious endowment of the honourable Mr. Boyle, are the beſt of all thoſe which bear that denomination, and are the application of natural philoſophy, particularly that of Sir Iſaac Newton, to theology. The union of theſe two ſtudies is what the Inquirer wiſhes to ſee ſupported, and his ſmall labours ſhall be hereafter, as they have been heretofore, directed to this end.

Soli DEO GLORIA.

N. B. The number on this page has the number of the pages in the addreſs and ſubſcribers names included in it. An index is not deemed neceſſary to this book, the title pages of the Lectures in a great meaſure anſwering that purpoſe.

Note alſo, that Mr. Henry Wray of this city, brother to the gentleman, who found the large Cryſtal mentioned page 178, near Ballycaſtle in the north of Ireland, weighing thirty pounds, is ready to atteſt the goodneſs of it; having a triangular ſeal of part of it, with his arms cut on it, alſo part of it in a ring, which has frequently been taken for a Diamond; the lapidary aſſuring him that it came neareſt to the hardneſs of a Diamond of any Cryſtal he ever cut.

ERRATA.

Page 63 for CLII. read CLIII.
Page 65 for CCIV. read CCLIV.
Line 9 page 130 for a neceſſity read no neceſſity.

